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**COMPUTER PROGRAMS FOR CALCULATING POTENTIAL  
FLOW IN PROPULSION SYSTEM INLETS**

by Norbert O. Stockman and Susan L. Button  
Lewis Research Center  
Cleveland, Ohio 44135

This information is being published in preliminary form in order to expedite its early release.

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ANALYSIS OF THE PROGRAMS

# COMPUTER PROGRAMS FOR CALCULATING POTENTIAL FLOW IN PROPULSION SYSTEM INLETS

by

Norbert O. Stockman and Susan L. Button

## INTRODUCTION

In the course of designing inlets at the Lewis Research Center, particularly for VTOL and STOL propulsion systems, a calculational procedure utilizing three computer programs evolved (refs. 1-3). The chief program is the Douglas axisymmetric potential flow program called EOD which calculates the incompressible potential flow about arbitrary axisymmetric bodies. The other two programs, original with Lewis, are called SCIRCL and COMBYN. Program SCIRCL generates input for EOD from various specified analytic shapes for the inlet components. Program COMBYN takes basic solutions output by EOD and combines them into solutions of interest, and applies a compressibility correction.

These programs are still in a state of development and users' manuals for them are not yet available. However, in the interests of making the programs available immediately, it was decided to publish the current versions in the "Quick Release" form with a minimum of write-up. First a brief summary of what each of the three programs does together with references to pertinent literature will be given. This is followed by a description of the input and output of programs SCIRCL and COMBYN. Next, listings of all three programs are given. Finally, a test case for checking-out the programs is presented.

It should be noted that programs SCIRCL and COMBYN were originally written for VTOL inlets and some of the input and output parameters are VTOL oriented.

## DESCRIPTION OF PROGRAMS

### SCIRCL

The purpose of this program is to supply accurate input to the potential flow program. To this end the inlet surfaces (e.g., hub and shroud) are divided into segments each of which is a portion of an analytical curve as illustrated in figure 1. The curves available are listed in the description of SCIRCL input. SCIRCL distributes points along the inlet surfaces in such a way as to meet the requirements of program EOD. The coordinates of these points are punched on cards for direct input to EOD along with other information required



by EOD. In addition, SCIRCL outputs printed information about the inlet surfaces (coordinates, curvature, slope, etc.).

In addition to the surface points, sets of points spanning the passage, like flow measuring rakes, are needed at axial locations where velocity profiles or streamlines are desired. At least one "rake" must be specified for use as a control station. (The function of the control station is given under COMBYN.) Program SCIRCL generates the coordinates of the rake points and punches them on cards for input to EOD.

EOD

This is the Douglas incompressible potential flow computer program for axisymmetric bodies. Only the bodies must be axisymmetric; the flow itself need not be. The details of the Douglas method are covered extensively in references 4 to 6; the highlights will be outlined herein.

1. Bodies are represented by a distribution of sources and sinks of initially unknown strengths.
2. An integral equation in the unknown source strength is derived from the potential flow equations and boundary conditions.
3. The integral equation is approximated by a set of linear algebraic equations corresponding to discrete points on the bodies.
4. These equations are solved for the source strength by matrix methods.
5. Velocities are calculated on the surface and at other points of interest (such as rake points) in the flow field from the source distribution obtained in step 4.

The program was originally written for closed bodies in a free stream. To apply the method to inlets, the inlets are idealized by adding artificial extensions to the inlet surfaces as shown in figures 2 and 3. The method of idealizing conventional inlets is given in reference 7 and that for lift fan or lift engine inlets in reference 2.

The Douglas program is used to obtain three basic solutions for the idealized inlet profile and certain free-stream conditions. The basic solutions are ones (e.g., as shown in fig. 4) that provide a convenient basis for generating the combined solutions that represent flow conditions of interest. The three basic solutions and the method of combining them are discussed in reference 2. Program EOD has been modified to output the basic solutions on punched cards for input to program COMBYN. No further description of EOD input or output will be given.

## COMBYN

This program combines the basic solutions from EOD into any number of solutions of interest. A solution of interest or combined solution is one having specified values of free stream velocity  $V_\infty$  and direction  $\alpha$  and control station velocity  $V_c$  (as shown in fig. 5 for a VTOL inlet). As an alternative to  $V_c$ , the inlet weight flow  $\dot{w}$  may be specified, in which case the program will convert  $\dot{w}$  to  $V_c$ . Temperature and pressure must also be specified if other than standard conditions are desired. These and other COMBYN inputs are described later. (Note that COMBYN requires  $\alpha_F$  rather than  $\alpha$  where  $\alpha_F = \alpha - 90^\circ$ .)

The method of combination of the basic solutions is essentially that given in reference 2 and is summarized in figure 5. The only major difference is in the compressibility correction. The current version of COMBYN uses the compressibility correction method of reference 8. This method is referred to in the COMBYN program listing as Approach 5 compressibility.

One of the "rakes" mentioned under SCIRCL is used as a control station by COMBYN. The control station is the rake at which the average inlet axial velocity  $V_c$  of the combined solution is specified. If there are several rakes any one may be used as the control station. It should be noted, however, that the solution is most accurate in the vicinity of the control station. The inaccuracies, which often are not significant, arise from the method of calculating the basic solution for inlets and from the compressibility correction which does not exactly satisfy continuity.

# DESCRIPTION OF INPUT AND OUTPUT

## SCIRCL INPUT

Card No.	Format	Fortran Name	Description
1	9A6	TITLE	Title card - used for input to EOD
2	2A6,I4	IDENT PROG NO6	Title number or case number =EOD for EOD axisymmetric punched output =22Y for 2-dimensional punched output =1 for basic data only from Douglas program =0 for all solutions in Douglas program
3	5F10.2	ANBDYS	Number of bodies (can handle 3) =1.0 shroud only =2.0 hub and shroud =3.0 hub, flow splitter* and shroud
		DELS	Spacing between points in region of interest
		DELSMX	Maximum spacing far from region of interest
		XRI	Axial distance at which surface distance equals zero
		ANNSD	Number of Noise Suppression Devices or NSD Splitters (acoustic splitters) (fig. 6), can equal zero.
4	I4	NRAKES	Number of axial locations at which data across the passage is desired, must be at least one (for the control station), cannot be greater than 25.
5	3F8.5,I3	XRAK	Axial location of rake ( $XRAK_i \leq XRAK_{i+1}$ ).

\*Flow splitter programming not complete through COMBIN. (Flow splitters extend far downstream, acoustic splitters do not.)

Card No.	Format	Fortran Name	Description
		YLO	Y value of first point on the rake at XRAK. If YLO = 0.0, the program will calculate a reasonable value for YLO provided the slope of nearby surface is not $> 45^\circ$ .
		YHI	Y value of last point on the rake at XRAK. If YHI = 0.0, the program will calculate a reasonable value for YHI provided the slope of nearby surface is not $> 45^\circ$ .
		NY	Number of points in rake at XRAK. Restriction, $\Sigma NY \leq 200$
		$\Delta Y = \left( \frac{YHI - YLO}{NY} \right)$	
		Rake points are equally spaced, $\Delta Y$ , between YHI and YLO.	
6	2F10.2	TYPBDY	<p>=1.0 for hub</p> <p>=2.0 for shroud if ANBDYS=2, for flow splitter* if ANBDYS=3</p> <p>=3.0 for shroud if ANBDYS=3</p> <p>=0.0 if shroud is to be mirror image of hub</p>
		ANSEG	=Number of segments for the particular body type. If TYPBDY = 0 it is the Y centerline used for mirroring. (Axis of symmetry)
7	F10.2, 10F7.2	ENFREED	<p>code indicating type of curve to be fitted through the given points, it is also the exponent for a supercircle when the exponent is to be specified.</p> <p>ENFREED = 0, SCIRCL program will calculate an exponent. Read in 5 coordinates (XIN and YIN). (fig. 7(a))</p> <p><math>1 &lt; \text{ENFREED} &lt; 10</math>, superellipse with exponent equal to ENFREED. Input coordinates 1,2,4,5. Read in 0.0 for point no. 3. (Point no. 3 is not used, but points 4 and 5 must be in the proper columns.) (fig. 7(b))</p>

\* (See note on previous page)

Card No.                      Format                      Fortran Name

Description

1001.< ENREED < 1010. The flag 1000. added to the code of desired superellipse is used on the shroud to give finer spacing at the highlight. The superellipse going into the highlight and the one on the topside of the highlight should have this flag.

ENREED = 1, is a straight line, input 2 coordinates (XIN(1), YIN(1), XIN(2), YIN(2)). (fig. 7(c))

ENREED = 10, special straight line used for closed bodies (example - airfoils). This straight line starts with large spacing (DELSMX) and ends with the small spacing (DELS). Input 2 coordinates. (fig. 7(d))

ENREED = -1, fits a lemniscate between a straight line and a point. Input is 3 coordinates. (fig. 7(e))

ENREED = -2, fits an ellipse between two straight lines. Input 4 coordinates. Restriction, the two straight lines should be at a right angle, therefore superellipse routine can be used. (fig. 7(f))

ENREED = -3, fits a cubic between 2 straight lines, input 4 coordinates. (fig. 7(g))

Coordinates for the particular configuration.

(XIN(I),  
YIN(I),  
I=1,5)

Should be ANSEG of #7 cards (i.e., there should be one #7 card for every segment).  
At this point repeat card no. 6 and no. 7 for each body number (ANBDYS).

If ANNSD > 0, read input for the NSD splitters.

8	F10.2	DELS	Spacing between points on the NSD splitter, can be different than DELS on the body.
---	-------	------	---

Card No.	Format	Fortran Name	Description
9	2I5	NSEG	=Number of segments on the NSD splitter. Note: for a thin NSD splitter, segments on the topside should begin and end with the same x values used as the corresponding segments on the lower side.

		NSHIGH	=Number of the segment on the underside of the NSD going into the highlight, equal to 1/2 of NSEG for thin splitters. Set NSHIGH = NSEG for all other splitters.
--	--	--------	--

10 Read in card no. 7, for each segment on the NSD. (i.e., ENREED, (XIN(I), YIN(I), I=1,5))

REMARKS, Total number of points for all the bodies should not exceed 400.

The first straight line on the shroud must be equal in axial length to the last straight segment on the hub. If the first straight line on the shroud is longer, us two segments.

Total number of off-body points must not exceed 200. If there are acoustic splitters in the area of a rake, specify ANNSD + 1 rakes for axial location of rake.

#### SCIRCL OUTPUT

#### PRINTED OUTPUT

Case Number

Number of bodies, DELS, DELSMX, XRI (Input)

Hub, Shroud, Splitter and Acoustic Splitters

Type of Segment, and input coordinates for the segment.

Interaction information if it applies (Superellipse, ellipse, lemniscate and cubic)

Other information includes,

Superellipse,

N = exponent of the superellipse

A and B = semi-major and minor axis of the transformed superellipse.

XO and YO = Center of the transformed superellipse

OMEGA = The difference between the slopes (in radians) of the superellipse end points minus  $\pi/2.0$ .

#### Cubic

A, B, C, and D are the coefficients for the cubic  
 $AX^3 + BX^2 + CX + D = 0$

#### Lemniscate

THETMX CALC = Angle between line 1-3 and line 1-2.

ACALC from equation  $R^2 = 2A^2 \sin 2\theta$  where  $\theta = \text{THETMX}$  and  $R^2 = (\text{XIN}(3) - \text{XIN}(2))^2 + (\text{YIN}(3) - \text{YIN}(2))^2$ .

#### Ellipse

A and B semi-major and minor axis of transformed ellipse.

XO and YO, center of the transformed ellipse

PHI angle of rotation

THETMX, theta of break point 3 in rotated system

#### Body Coordinates

Point number

X - axial distance

Y - radial distance

KAPPA - curvature

DY/DX - slope

S - surface distance measured from the first point (same as SUMDS in EOD output)

S-S(2) - surface distance measured from XRI (Same as S in COMBYN output)

DELTAS - distance between points

#### Rake Information

XRAK - Axial location of the rake

YLO - Y value of first location on rake (either read in value or computed value)

YHI - Y value of last point on the rake (either read in value or computed value)

NDY - Number of Y points calculated for XRAK.

# Area Output

I - point number  
 XON - axial location  
 YON - Y value on the shroud  
 YONH - interpolated Y value on the hub  
 AREA - Annular area between hub and shroud, (if there is not hub, AREA is the disc area)  
 Where an NSD is located there are extra values, these are the individual areas between the bodies. The last value is the total area.  
 DISC AREA - area as if there were no hub.

# Punched Output

The punched output from SCIRCL is used directly as input to EOD. DO NOT INCLUDE I.D. CARD.

# COMBYN INPUT

English engineering units are used throughout the program.

Length - inches  
 Velocities - ft/sec  
 Angles - degrees  
 Pressures - lb/ft<sup>2</sup>  
 Temperature - degrees R  
 Densities - slug/ft<sup>3</sup>  
 Force - lbs  
 Weight flow - lbs/sec

Card No.	Format	Fortran Name	Description
1	12A6	TITLE	Title card
2	8I4	NT(1)	Number of on-body points for the closed-end solution.
		NP(1)	Total number of off-body points



Card No.	Format	Fortran Name	Description
		NT(2)	Number of on-body points for the open-end solution (eliminate the last body)
		NP(2)	Total number of off-body points
		NID	Number of I.D. cards from EOD output, (usually 1, unless the closed end and open end case were run separately, then NID=2)
		KSKIP	=0 for 1 case of COMBYN =1 for successive cases using the same EOD output.
		N4SOL	=0 when there are 3 solutions from EOD, (one axisymmetric solution for the closed-end and open-end cases, and one crossflow solution for the open-end case) =1 when there are 4 solutions from EOD (two axisymmetric and two crossflow)
		NSPLT	=number of noise suppression devices, (NSD), can equal zero.
3	20I4	(NSPB(I), NSPE(I), I=1,NSPLT)	If there are not NSD omit this card. NSPB - Number of right most point on the splitter. NSPE - Number of the left most point on the splitter. NOTE - The first splitter is the one closest to the hub and the last splitter is the one closest to the shroud.
4	10F8.5	VC	Average axial velocity at the control station. Based on live flow area, i.e., the flow area minus the area associated with the boundary layer displacement thickness. If VC = 0.0 the program will interpret this as a code and will calculate VC from WDOT. (To run a case with VC actually equal to zero set WDOT = 0.0.)
		VINF	Free-stream velocity

Card No.	Format	Fortran Name	Description
		ALFAF	Angle of attack, 0.0 for free-stream perpendicular to inlet axis. Note that $\alpha_F = \alpha - 90^\circ$ .
		TTOTAL	Total temperature, if PSTAT and TSTAT are read in (to be explained later), the program will calculate TTOTAL. If TTOTAL = 0 and PSTAT and TSTAT = 0, then TTOTAL = 518.67.
		EIIND	EIIND is the arbitrary length used for normalizing - Refer to KIND input, card number 6.
		YWING	Upper limit of integration for surface forces (used in subroutine INFRCE*).
		UTIP	Rotor tip speed. Need not be input unless relative rotor inlet quantities are desired. (See COMBYN output)
		VA	Bulk velocity at control station, i.e., average inlet axial velocity based on geometric area. If VA = 0.0, the program will interpret this as a code and set VA = VC.
		PT	Total pressure, if PT = 0.0 the program will set PT = 2116.
5	10F8.5	PSTAT TSTAT	Static pressure Static temperature (If PSTAT and TSTAT are not 0.0, total pressure (PT) and total temperature (TTOTAL) will be calculated using PSTAT and TSTAT.
		WDOT	Weight flow - used only if VC is input as 0.0.
6	10I4	NTHETA	Number of THETAS, where THETA is the circumferential coordinate.
		NCLO	One rake must be chosen as the control station, NCLO is the number of the first point on the rake.

\*INFRCE subroutine not included in this version of COMBYN.

Card No.	Format	Fortran Name	Description
		NCHI	NCHI is the number of the last point on the control station rake.
		NX	Set = 0.0 (was used for INFRCE*).
		KND	Flag used for non-dimensionalizing, KND = -1, ELND = YRISHR KND = 0, ELND = 1.0 (no nondimensionalizing) KND = 1, ELND = YRISHR - YRIHUB KND = 2, ELND is the read in value For the above the velocities are normalized by VC.  KND = 4 same as KND = -1 but VA is used for normalizing velocities.  KND = 5 same as KND = 0, velocities normalized by VA  KND = 6 same as KND = 1, velocities normalized by VA
7	10E8.5	(THETA(I), I=1,NTHETA)	Circumferential coordinate in degrees, (Number of THETA'S read in depends on NTHETA)
8	10E8.5	XTEST	Only used for INFRCE* -- axial location of control surface, usually equal to XRI.
9	3E10.5, I4	XRI	Value of X at which the surface distance is zero. Usually equal to the X at the control station.
		YRIHUB	Y on the hub at XRI.
		YRISHR	Y on the shroud at XRI.
		NHUBMX	The number of the last point on the hub (this can be found in the printed output of SCIRCL).

\* Same as previous page.

At this point, the binary cards from EOD, including the I. D. card are inserted.

# COMBYN OUTPUT

TITLE - COMPRESSIBLE COMBYN APPROACH 5 followed by title on title card.

Based on Basic Data From xx/xx/xx Run No. xxx and xx/xx/xx Run No. xxx -- The data and run number came from the punched I. D. card from EOD punched output.

In the table that follows, several functions of three different velocities are given. The velocities are:

Control; VC, Average axial velocity at the control station. (See Input) (The control station is determined by NCLO and NCHI.)

Bulk; VA, Bulk velocity at the control station. (See Input)

Free stream,  $V_{\infty}$ , Free stream velocity.

The rest of the table is self-explanatory except perhaps the terms INC and COMP. INC means calculated from incompressible flow equations and COMP means calculated from compressible flow equations.

The rest of the output will be defined by the output name:

ALPHAF Angle of attack of wing containing VTOL Inlet. (i.e., the angle between the free stream velocity and a line perpendicular to the inlet axis)

VINF/VC  $V_{\infty}/V_C$

VINF/VA  $V_{\infty}/V_A$

VC/VA  $V_C/V_A$

VSONIC Critical velocity uncorrected for compressibility

VSONICC Critical velocity at control station

TSTAT	Free stream static temperature
PSTAT	Free stream incompressible static pressure
PSTATIC	Free stream compressible static pressure
ASTAT	Free stream static speed of sound
RHOSTAT	Free stream static density
WDOT	Input mass flow
VIC	Incompressible average velocity at the control station
TTOTAL	Free stream total temperature
PTOT	Free stream total pressure incompressible.
PTOTC	Free stream total pressure compressible
ATOT	Free stream stagnation speed of sound
RHOTOT	Free stream stagnation density
THET	TTOTAL/518.67
DEL	PTOTC/2116.22
XRI	Input - Value of X at which the surface distance is zero. Usually equal to X at the control station.
YRIHUB	Input - Y on the hub at XRI
YRISHR	Input - Y on the shroud at XRI
HUB-TIP RATIO	YRIHUB/YRISHR
LND	Input - arbitrary length used for normalizing

XTEST	Input - used for subroutine INFRCE*
YWING	Input - used for subroutine INFRCE*
NT	1 - number of on-body points for the closed-end solution
	2 - number of on-body points for the open-end solution
NP	1 & 2, total number of off-body rake points
NCLO	Input, number of the first point on the control station rake
NCHI	Input, number of the last point on the control station rake
NHUEMX	Input - the number of the last point on the hub
NX	Input code for INFRCE*
KND	See input
KSKIP	See input
V1	Average axial velocity at the control station of basic solution #1. Closed-end.
V2	Average axial velocity at the control station of basic solution #2. Open-end.
A,B,C	Coefficients of combination. (ref. 2)
VINFP	Input free stream velocity uncorrected for compressibility.
THETA	Input - circumferential coordinate in degrees
WDOIT	Local weight flow at the circumferential station given by THETA
VICT	Local VIC at given THETA

\*Same as page 11.

V3 Local average control station velocity of crossflow basic #3 solution at a given  $\theta$

# ON-BODY POINTS (hub, shroud and if applicable NSD)

I	The index number of each on-body point
X	Axial distance
Y	Radial distance
VP	Velocity component tangent to body profile in an X,Y plane
VTHETA	Circumferential velocity component
VRES	Resultant velocity ( $VP^2 + VTHETA^2$ ) <sup>1/2</sup>
VBARI	Average incompressible velocity at a given axial location (X)
BETA	Flow angle
S	Surface distance from XRI
CPC	Pressure coefficient compressible = $\frac{PSOPTC - PSOPTC_{\infty}}{QCA/PT}$
RB/RT	$\bar{P}_c/\rho_t$ at axial location (X)
PSOPTC	Static to total pressure ratio, compressible = $\left[ 1 - .2 \left( \frac{V}{a_t} \right)^2 \right]^{3.5}$

## OFF-BODY POINTS (RAKES)

I	Number of the off-body point (points without numbers in I column are interpolated points on hub, shroud or splitter surfaces)
X	Axial distance - for each rake
Y	Radial distance

VX	Axial velocity component $V_x$	} These velocities are obtained from EOD basic data and constants of combination.
VI	Radial velocity component $V_y$	
VZ	Circumferential velocity component $V_z$	
VRES	Resultant velocity $= V_x^2 + V_y^2 + V_z^2 = V_{res}^2$	
VM	Meridional velocity component $V_x^2 + V_y^2 = V_m^2$	
VAFT	Velocity component in aft direction $= V_z \sin \theta + V_y \cos \theta$	
VSPAN	Velocity component in spanwise direction $= V_y \sin \theta - V_z \cos \theta$	
RHOBR	$\bar{p}/\rho_t$	
PSOPTC	Pressure ratio-compressible	
I	} Same as above	
X		
Y		
VBRI	Average incompressible velocity at a given axial location X	
CPC	Pressure coefficient (compressible) $CPC = \frac{PSOPTC - PSOPTC_{\infty}}{QCA/PT}$	
ALPHA	Meridional flow angle $= \tan^{-1} (V_y/V_x)$ , inlet oriented, cylindrical coordinate system.	
BETA	Flow angle $= \tan^{-1} (V_z/V_m) = \sin^{-1} (V_z/V_{res}) = \cos^{-1} (V_m/V_{res})$ , inlet oriented, cylindrical coordinate system	
ETA	Underturning angle $= \tan^{-1} (V_{aft}/V_x)$ , wing oriented, rectangular coordinate system for VTOL inlet	



ZETA Spanwise flow angle =  $\tan^{-1} (V_{\text{span}}/V_x)$ , wing oriented, rectangular coordinate system for VTOL inlet

PHI Swirl angle =  $\tan^{-1} (V_z/V_x)$ , inlet oriented, cylindrical coordinate system

QFRACT Stream function

#### RELATIVE ROTOR INLET DATA

X Equal to XRI

UTIP Rotor tip speed

Y Local radius at  $X = XRI$

U Local rotor speed =  $\frac{UTIP * Y}{YRISHR}$  at radius Y

The following quantities relative to a rotor rotating at tip speed = UTIP are calculated at  $\theta = \theta$

VZPRIME Circumferential velocity component relative to rotor =  $SIGN * VZ - U$  where  $SIGN = SIGN \text{ of } \sin \theta$

VPRIM Relative velocity  $VM/\cos \beta$

MPRIME Relative Mach number =  $(V'/a_t) / [1.0 - .2 (V_{\text{res}}/a_t)^2]^{1/2}$

BETAPR Relative flow angle =  $ATAN (V_z'/V_M)$

The following are the same as above, but calculated at  $\theta_{ST} = 360. - \theta$

VZPRST

VPRST

MPRS

BETAPS

# RAKE WEIGHT FLOW DATA

I	The number of each rake
X	Axial location of the rake
$\frac{Q(I)-QBAR}{QBAR}$	Weight flow disparity parameter where $Q(I)$ is integrated weight flow at rake #I and QBAR is integrated weight flow at control station
QSTOT	Total weight flow for each rake
QFR	Fraction of weight flow for each rake at a given axial location

## STREAMLINES

There are data for streamlines for every axial rake position, X

QSTRM	Value of stream function (increment of .02 is set in program)
YSTRM	Corresponding y value

## LISTINGS OF PROGRAMS

# SCIRCL

\*IBFIC SCIRCL

C PREPARE INPUT DATA FOR DOUGLAS POTENTIAL FLOW PROGRAMS EOD AND 22Y  
C  
C SECOND VERSION - SPACING SPECIFIED  
C

DIMENSION SD(500), S(500), NY(25)  
COMMON /SUPP/ IFLO  
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIC2,DELS1,IHUB  
COMMON /SS/ NBDY1,NBCDY2,TYPEDY,NBCYS  
COMMON /WRITE/ IFLAG,NDY4,PRCG,TITLE(9),BODIES(4),IDENT,YLO(25),YH  
1J(25),NDY(25),XRAK(25),NBDPTS(5),NC6,NRAKES  
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /SPREP/ KPREP  
COMMON /NNSD/ NNSD,NNSBDY(10)  
COMMON /NHIGH/ NSPHG,NLAST,XLAST(500),YLAST(500)  
PI=3.14159265  
PIC180=PI/180.  
PIC2=PI/2.

C  
C WHEN NO6 = 1, A FLAG IN CARD COLUMN 6 IS PUNCHED FOR 500  
C ONLY BASIC DATA WILL BE GIVEN IN 500 PROGRAM 7  
C

2 READ (5,84) TITLE  
READ (5,82) IDENT,PRCG,NO6  
WRITE (6,84) IDENT

C  
C READ INPUT CARDS FOR SUPERCIRCLE  
C 1 -- CASE HEADER CARD -- NO. OF BODIES,CASE NO.,DELS,DELSMX  
C OFF-BODY  
C 2 -- NRAKES = NUMBER OF RAKES (TOTAL NUMBER CANNOT EXCEED 25)  
C 3 -- X,YLO,YHI, NY (DATA FOR EACH RAKE)  
C X = X OF THE RAKE,  
C YLO = Y OF THE FIRST PT. ON RAKE CLOSEST TO THE HUB - SHOULD BE  
C ABOUT DS GREATER THAN Y ON HUB  
C YHI = Y OF THE LAST PT ON RAKE CLOSEST TO THE SHROUD - SHOULD BE  
C ABOUT DS LESS THAN Y ON SHROUD  
C NY = NC. OF PTS TO GENERATE FOR THAT RAKE  
C ON-BODY  
C FOR EACH SEGMENT A DESCRIPTION CARD IS NEEDED,  
C THIS CARD DENOTES THE TYPE OF LINE, AND THE  
C COORDINATES OF THE LINE (UP TO 5 SETS)  
C

READ (5,106) ANBCYS,DELS,DELSMX,XRI,ANNSE  
READ (5,80) NRAKES  
READ (5,104) (XRAK(I),YLO(I),YHI(I),NY(I),I=1,NRAKES)  
DEPLG(XRAK(I),YLO(I),YHI(I),NDY(I),I=1,NRAKES)  
WRITE (6,78) ANBCYS,DELS,DELSMX,XRI  
DO 4 I=1,NRAKES  
4 NDY(I)=NY(I)-1

```

NLAST=0
NSPFC=0
DELS2=DELS
DELS1=DELS
NBDYS=ANBDYS
NNSC=ANNSD

```

```

K = COUNTER FOR THE NUMBER OF ONBODY POINTS GENERATED
IHUB = 0, WHEN THERE IS ONLY ONE BODY-- IF THERE IS ONE BODY
IT MUST BE THE SPROUD
IFLAG = 0, IF THERE IS MORE THAN ONE BODY

```

```

K=0
IHUB=0
IFLAG=0

```

```

NZ LOOP IS FOR THE NUMBER OF BODIES

```

```

DO 26 NZ=1,NBDYS
IF (NZ.GE.2) IHUB=1

```

```

TYPBDY = 1 FOR HUB ---- TYPBDY = 2 FOR SPROUD

```

```

OR

```

```

TYPBDY=1 FOR HUB * TYPBDY=2 FOR FLOW SPLITTER * TYPBDY=3 FOR SHROU
*****FLOW SPLITTER PROGRAMMING IS NOT COMPLETE THROUGH COMBYN*****
*****FLOW SPLITTER IS NOT THE SAME AS NOISE SUPPRESSION DEVICES

```

```

(N.S.C.) SPLITTERS*****

```

```

OR

```

```

IF THE HUB IS TO BE MIRRORED , SET TYPBDY FOR THE SPROUD = 0.0

```

```

READ (5,106) TYPBDY,ANSEG

```

```

NSEG=ANSEG

```

```

IF (NBDYS.EQ.2.AND.NZ.EQ.2.AND.TYPBDY.NE.0.0) TYPBDY=3.0

```

```

IF (NBDYS.EQ.1.AND.TYPBDY.EQ.2.0) IFLAG=1

```

```

IF (TYPBDY.EQ.1.) WRITE (6,120)

```

```

IF (TYPBDY.EQ.3.0.OR.TYPBDY.EQ.0.0.OR.NBDYS.EQ.1) WRITE (6,122)

```

```

IF (TYPBDY.EQ.0.0) GO TO 24

```

```

IF (TYPBDY.EQ.2.0.AND.NBDYS.GT.1) WRITE (6,124)

```

```

K=K+1

```

```

SON(K)=0.0

```

```

SEGMENT LOOP

```

```

DO 22 J=1,NSSEG

```

```

READ (5,108) ENREED,(XIN(I),YIN(I),I=1,5)

```

```

KSV=K

```

```

CAPPA(K)=0.0

```

```

IF (ENREED.NE.1.0.AND.ENREED.NE.10.) GO TO 10

```

```

XCN(K)=XIN(1)

```

```

YCN(K)=YIN(1)

```

```

WRITE (6,112) ENREED,(XIN(I),I=1,2),(YIN(I),I=1,2)

```

```

DEBUCXCN(K),YCN(K),TYPBDY,K,ENREED,NSSEG,J,(XIN(I),YIN(I),I=1,5)

```

```

IF (TYPBDY.GE.2.0) GO TO 8

```

```

IF (ENREED.EQ.1.0.AND.J.EQ.NSSEG) CALL FNSTRH (K)

```

```

IF (ENREED.EQ.1.0.AND.J.NE.NSSEG) CALL STRAIT (K,0.0)

```

```

IF (ENREED.EQ.10.) CALL FRSTSH (K)

```

```

6      DYDXC(KSV)=DYDXO(KSV+1)
      ALPHA(KSV)=ALPHA(KSV+1)
      GO TO 22
8      IF (J.EQ.1) CALL FRSTSH (K)
      IF (J.EQ.NSEG) CALL FNSTRH (K)
      IF (J.NE.1.AND.J.NE.NSEG) CALL STRAIT (K,U.0)
      GO TO 6
10     IF (ENREED.LT.-2.0) GO TO 20
      IF (ENREED.LT.-1.0) GO TO 18
      IF (ENREED.LT.0.0) GO TO 16
C
C      SET-UP SUPER ELLIPSE
C
      KPREP=0
      ENRC=ENREED-1000.
      IF (ENRC.LT.0.0) GO TO 12
      ENREED=ENREED-1000.
      IFLC=IFLC+1
      GO TO 14
12     IFLC=0
14     WRITE (6,114) ENREED,(XIN(I),I=1,5),(YIN(I),I=1,5)
      CALL TEST (5)
      ISTART=K
      K1=K
      CALL SUPERC (XIN,YIN,ENREED,DELS1,ISTART)
      K=I-1
      K2=K
      ICLM=0
      IF (KPREP.EQ.0) GO TO 22
      CALL PRELPS (IDUM,1,5,K1,K2)
      GO TO 22
C
C      SET-UP LEMNISCATE
C
16     WRITE (6,116) ENREED,(XIN(I),I=1,3),(YIN(I),I=1,3)
      CALL LEM (K)
      K=K+1
      GO TO 22
C
C      SET-UP ELLIPSE
C
18     WRITE (6,118) ENREED,(XIN(I),I=1,4),(YIN(I),I=1,4)
      KPREP=0
      CALL TEST (4)
      K1=K
      CALL ELIPSE (K)
      K=K+1
      K2=K
      IDUM=0
      IF (KPREP.EQ.0) GO TO 22
      CALL PRELPS (IDUM,1,4,K1,K2)
      GO TO 22
C
C      SET-UP CUBIC
C
20     WRITE (6,126) ENREED,(XIN(I),I=1,4),(YIN(I),I=1,4)

```

```

CALL CUBIC (K)
K=K+1
22 CONTINUE
C
C END OF SEGMENT LOOP
C
GO TO 26
24 CALL MIRROR (K,ANSEG)
26 NBDPTS(N2)=K
NBDY1=NBDPTS(1)
NBDY2=NBDPTS(2)
28 CONTINUE
C
C END OF BCDY LOOP
C
ITCPT12=K
C
C **N.S.D. SPLITTER SUBROUTINE
C
IF (NNSD.NE.0) CALL SUPRD (K)
IF (IFLAG.EQ.1) NBDY1=0
Y4SAVE=YCN(NBDY1)
Y5SAVE=YCN(NBDY1+1)
Y6SAVE=YCN(NBDY2)
Y7SAVE=YCN(NBDY2+1)
DEBUC(XON(I),YON(I),DYDXO(I),ALPHA(I),CAPPA(I),SON(I),SON(I),SON(I),I=1,K)
C9
C
C CO-ORDINATES OF POINTS ON DOWNSTREAM CLOSURE
C
C STRAIGHT SECTION BETWEEN HUB AND SHROUD OR SPLITTER
C
C
IF (NBDY1.EQ.0) GO TO 30
YNBDY1=YCN(NBDY1)
GO TO 32
30 YNBDY1=0.0
Y4SAVE=0.0
32 NDY4=(YCN(NBDY1+1)-YNBDY1)*1.5/DELSMX
ENDY4=NDY4
NPTS=NDY4+1
NBDPTS(NBDYS+1)=NPTS+NBDPTS(NBDYS)
DY4=(YCN(NBDY1+1)-YNBDY1)/ENDY4
GO 34 I=1,NPTS
AYEM=I-1
IPN=I*K
XCN(IPN)=XCN(NBDY1+1)
YON(IPN)=YNBDY1+AYEM*DY4
34 CONTINUE
ITCPT14=K+1
ITCPT15=ITCPT14+NDY4
IF (NBDYS.LE.2) GO TO 38
C
C

```

C  
C  
C

# STRAIGHT SECTION BETWEEN FLOW SPLITTER AND SHROUD

36

C  
C  
C

38

40

42

44

46

48

50

52

```

YNBDY2=Y6SAVE
NDY5=(Y7SAVE-Y6SAVE)*1.5/DELSMX
ENDY5=NDY5
NP15=NDY5+1
NBODPTS(NBDY5+2)=NPTS+NBDPTS(NBDY5+1)
DY5=(Y7SAVE-Y6SAVE)/ENDY5
DO 36 I=1,NPTS
  AYEM=I-1
  IPN=1+ITCPT5
  XCN(IPN)=XCN(NBDY2+1)
  YCN(IPN)=YNBDY2+AYEM*DY5
  CCNTINUE
  ITCPT6=ITCPT5+1
  ITCPT7=ITCPT6+NDY5

```

## CALL SUBROUTINE TO WRITE AND PUNCH CARDS

```

CALL WPLNCH
IF (NBDY5.GT.2) GO TO 40
NT1=ITOP15-3
NT2=K-2
GO TO 42
NT1=ITOP17-5
NT2=ITOP15-4
NT3=K-3
NSPLMX=NECCY2-2
NHFLPMX=NECY1-1
NP=C
DO 44 I=1,NRAKES
  NP=NP+NDY(I)+1
  CCNTINUE
  NFBPMX=NFLPMX
  IF (NBDY5.LE.2) GO TO 46
  WRITE (6,110) NT1,NT2,NT3,NHUBMX,NSPLMX,NP
  GO TO 48
  WRITE (6,100) NT1,NT2,NHUBMX,NP

```

## CALCULATING HUB SURFACE DISTANCE (S-S(2))

```

CALL SINTP (XON,SON,NBDY1,XRI,S2)
WRITE (6,86)
IF (IFLAG.EQ.1) GO TO 52
SDEL=0.0
DO 50 I=1,NBDY1
  IF (I.NE.1) SDEL=SON(I)-SON(I-1)
  SD(I)=SON(I)-S2
  WRITE (6,92) I,XCN(I),YCN(I),CAPPA(I),DYEXC(I),ALPHA(I),SON(I),SD(
11),SDEL

```

## CALCULATION SHROUD OR LOWER FLOW SPLITTER SURFACE DISTANCE

```

NBPI=NBDY1+1
IF (IFLAG.EQ.1) NBDY2=ITOP12

```



```

      DO 54 I=NBP1,NBODY2
      JJ=I
      IF (XON(I).LT.XON(I+1)) GO TO 56
54    CONTINUE
56    CALL SINIP (XON(NBP1),SON(NBP1),JJ-NBODY1,XRI,S22)
      IF (IFLAG.EQ.1) GO TO 58
      WRITE (6,88)
58    IF (NBDYS.LE.2) JJ=NBODY2
      SDEL=0.0
      DO 60 I=NBP1,JJ
      IF (I.NE.NBP1) SDEL=SON(I)-SCN(I-1)
      S(I)=S22-SCN(I)
60    WRITE (6,92) I,XON(I),YON(I),CAPPA(I),DYCX(I),ALPHA(I),SON(I),S(I)
      IF (NBDYS.LE.2) GO TO 70
C
C      CALCULATING FLOW SPLITTER UPPER SURFACE DISTANCE
C
      JJ=JJ+1
      WRITE (6,96)
      CALL SINIP (XON(JJ),SON(JJ),NBODY2-JJ,XRI,S23)
      SDEL=0.0
      DO 62 I=J,NBODY2
      IF (I.NE.JJ) SDEL=SON(I)-SON(I-1)
      S(I)=SON(I)-S23
62    WRITE (6,92) I,XON(I),YON(I),CAPPA(I),DYCX(I),ALPHA(I),SON(I),S(I)
      IF (I.NE.JJ) SDEL=SON(I)-SON(I-1)
C
C      CALCULATING SHROUD SURFACE DISTANCE (IF THERE IS A FLOW SPLITTER)
C
      NBP1=NBODY2+1
      DO 64 I=NBP1,ITOP12
      JJ=I
      IF (XON(I).LT.XON(I+1)) GO TO 66
64    CONTINUE
66    CALL SINIP (XON(NBP1),SON(NBP1),JJ-NBODY2,XRI,S33)
      WRITE (6,98)
      SDEL=0.0
      DO 68 I=NBP1,ITOP12
      IF (I.NE.NBP1) SDEL=SON(I)-SCN(I-1)
      S(I)=S33-SCN(I)
68    WRITE (6,92) I,XON(I),YON(I),CAPPA(I),DYCX(I),ALPHA(I),SON(I),S(I)
      IF (I.NE.NBP1) SDEL=SON(I)-SCN(I-1)
C
C      WRITE OUT N.S.D. SPLITTER POINTS
C
70    NBDYS=NBDYS
      IF (INNSD.EQ.0) GO TO 74
      NS=1
72    IBC=NBDYS+NS
      INSD=I+NBDYS(NS)
      IBNSD=I+1
      WRITE (6,128) IBC
      WRITE (6,130) (I,XON(I),YON(I),CAPPA(I),DYCX(I),ALPHA(I),SON(I),I
      I=IBNSD,INSD)
      NS=NS+1

```

```

      IF (NS.LE.NNSD) GO TC 72
      NBDYS=IBD
C
C      WRITE OUT CLOSURE COORDINATES
C
74      IBC=NBDYS+1
      WRITE (6,9C) IBD,(I,XON(I),YCN(I),I=ITOPT4,ITOPT5)
      IF (NBDYS.NE.3) GO TC 76
      IBC=IBD+1
      WRITE (6,9C) IBD,(I,XON(I),YCN(I),I=ITOPT6,ITOPT7)
76      WRITE (6,1C2) (XRAK(I),YLO(I),YHI(I),NY(I),I=1,NRAKES)
      CALL AREA
      GO TC 2
C
C      FORMATS
C
78      FORMAT (1HC,10X,16HNC. OF BODIES = ,F2.0,5X,7HDELS = ,F6.3,5X,9HDE
      ILSMX = ,F6.3,5X,6HXRI = ,F10.6)
80      FORMAT (2C14)
82      FORMAT (2A6,14)
84      FORMAT (5A6)
86      FORMAT (1X/1X23HBCDY 1 CO-ORDINATES - X12X1HY10X5HKAPPA10X5HDY/DX1
      10X5HALPHA5X1HS8X6HS-S(2),8X,6HDELTAS/1X)
88      FORMAT (1X/1X23HBCDY 2 CO-ORDINATES - X12X1HY10X5HKAPPA10X5HDY/DX1
      10X5HALPHA5X1HS,8X,7HS'(2)-S,8X,6HDELTAS/1X)
90      FORMAT (1X/1X5HBCDY 11,17H CO-ORDINATES - X12X1HY/1X/(9X14,3XE12.5
      1,E13.5))
92      FORMAT (5X14,3XE12.5,7E13.5)
94      FORMAT (6H1CASE A6/1X)
96      FORMAT (1HC)
98      FORMAT (1X/1X,23HBCDY 3 CO-ORDINATES - X,12X,1HY,10X,5HKAPPA,10X,5
      1HDY/DX,10X,5HALPHA,5X,1HS,8X,6HS-S(3),8X,6HDELTAS/1X)
100     FORMAT (/10X,30H INPUT FOR THE COMBINE PROGRAM,7H NT(1)=,14,7H NT(
      12)=,14,8H NHUBMX=,14,4H NP=,14/)
102     FORMAT (1X,4HXRAK,10X,3HYLO,11X,3HYHI,16X,3HNDY//,(3E14.5,5X,13))
104     FORMAT (2E8.5,13)
106     FORMAT (6F10.2)
108     FORMAT (F1C.2,10F7.2)
110     FORMAT (/5X,30H INPUT FOR THE COMBINE PROGRAM,7H NT(1)=,14,7H NT(2
      1)=,14,7H NT(3)=,14,8H NHUBMX=,14,8H NSPLMX=,14,4H NP=,14/)
112     FORMAT (1HC,10X,6HENREED,10X,13HSTRAIGHT LINE/11X,F6.3,5X,1HX,1P2E
      115.4/22X,1HY,1P2E15.4)
114     FORMAT (1HC,10X,6HENREED,10X,12HSUPERELLIPSE/11X,F6.3,5X,1HX,1P5E1
      15.4/22X,1HY,1P5E15.4)
116     FORMAT (1HC,10X,6HENREED,10X,10HLEMNISCATE/11X,F6.3,5X,1HX,1P3E15.
      14/22X,1HY,1P3E15.4)
118     FORMAT (1HC,10X,6HENREED,10X,7HELLIPSE/11X,F6.3,5X,1HX,1P4E15.4/22
      1X,1HY,1P4E15.4)
120     FORMAT (1HC,2X,18H**** HUB *****)
122     FORMAT (1HC,2X,18H**** SHROUD *****)
124     FORMAT (1HC,2X,18H**** SPLITTER ****)
126     FORMAT (1HC,10X,6HENREED,10X,5HCUBIC/11X,F6.3,5X,1HX,1P4E15.4/22X,
      11HY,1P4E15.4)
128     FORMAT (1X/1X,5HBCDY,12,17H CO-ORDINATES - X,12X,1HY,10X,5HKAPPA,1
      10X,5HDY/DX,10X,5HALPHA,5X,1HS,8X,6HS-S(2),8X,6HDELTAS/1X)
130     FORMAT (5X,14,3X,E12.5,5E13.5)
      ENC

```

\$IBFTC SUPRD.

C SUBROUTINE TO HANDLE NOISE SUPPRESSION DEVICE SPLITTERS

C  
SUBROUTINE SUPRD (K)  
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIQ2,DELS1,IHUR  
COMMON /ANSD/ ANSD,NSDBDY(10)  
COMMON /SPREP/ KPREP  
COMMON /NSHIGH/ NSPHG,NLAST,XLAST(500),YLAST(500)  
COMMON /SUPP/ IFLD  
IFLD=0  
READ (5,20) DELS  
DELS1=DELS  
DO 16 N=1,ANSD  
NSPHG=0  
K=K+1  
WRITE (6,18) N  
KNSD=K

C  
C NSEG = NUMBER OF SEGMENTS ON THE SPLITTER  
C NSHIGH = NSEG/2 FOR THIN SPLITTERS  
C = NSEG ( FOR ALL OTHER SPLITTERS )  
C

READ (5,22) NSEG,NSHIGH  
DO 14 J=1,NSSEG  
READ (5,24) ENREED,(XIN(I),YIN(I),I=1,5)  
IF (J.GT.NSHIGH) NSPHG=1  
KSV=K  
CAPPA(K)=0.0  
IF (ENREED.NE.1.0) GO TO 2  
XCN(K)=XIN(1)  
YCN(K)=YIN(1)  
NLAST=NLAST+1  
WRITE (6,26) ENREED,(XIN(I),I=1,2),(YIN(I),I=1,2)  
CALL STRAIT (K,0.0)  
DYDXC(KSV)=DYDXO(KSV+1)  
ALPHA(KSV)=ALPHA(KSV+1)  
GO TO 12  
2 IF (ENREED.LT.-2.0) GO TO 10  
IF (ENREED.LT.-1.0) GO TO 8  
IF (ENREED.LT.0.0) GO TO 6

C  
C SET-UP SUPERELLIPSE  
C

KPREP=0  
WRITE (6,28) ENREED,(XIN(I),I=1,5),(YIN(I),I=1,5)  
CALL TEST (5)  
ISTART=K  
KI=K  
CALL SUPERC (XIN,YIN,ENREED,DELS1,ISTART)

```

K=I-1
K2=K
IDUM=0
DO 4 KL=K1,K2
  YLAST(KL)=YCN(KL)
4  XLAST(KL)=XCN(KL)
  IF (KPREF.EQ.0) GO TO 12
  CALL PRELPS (IDUM,1,5,K1,K2)
  GO TO 12

C
C  SET-UP LEMNISCATE
C
6  WRITE (6,30) ENREED,(XIN(I),I=1,3),(YIN(I),I=1,3)
  CALL LEM (K)
  K=K+1
  GO TO 12

C
C  SET-UP ELLIPSE
C
8  WRITE (6,32) ENREED,(XIN(I),I=1,4),(YIN(I),I=1,4)
  KPREF=0
  CALL TEST (4)
  K1=K
  CALL ELIPSE (K)
  K=K+1
  K2=K
  IDUM=0
  IF (KPREF.EQ.0) GO TO 12
  CALL PRELPS (IDUM,1,4,K1,K2)
  GO TO 12

C
C  SET - UP CUBIC
C
10 WRITE (6,34) ENREED,(XIN(I),I=1,4),(YIN(I),I=1,4)
  CALL CURIC (K)
  K=K+1
12 IF (J.EQ.NSHIGH) NLAST=K
14 CONTINUE

C
C  NUMBER OF PTS ON EACH NSD
  NSCDBY(N)=K-KNSD+1
16 CONTINUE
  RETURN

C
C  FORMATS
C
18 FORMAT (1HC,2X,23H**** SPLITTER(NSC) NO. ,I2)
20 FORMAT (8F10.2)
22 FORMAT (16I5)
24 FORMAT (F10.2,10F7.2)
26 FORMAT (1HC,10X,6HENREED,10X,13HSTRAIGHT LINE/11X,F6.3,5X,1HX,1P2E
115.4/22X,1HY,1P2E15.4)
28 FORMAT (1HC,10X,6HENREED,10X,12HSUPERELLIPSE/11X,F6.3,5X,1HX,1P5E1
15.4/22X,1HY,1P5E15.4)
30 FORMAT (1HC,10X,6HENREED,10X,10HLEMNISCATE/11X,F6.3,5X,1HX,1P3E15.
14/22X,1HY,1P3E15.4)
32 FORMAT (1HC,10X,6HENREED,10X,7HELLIPSE/11X,F6.3,5X,1HX,1P4E15.4/22
1X,1HY,1P4E15.4)
34 FORMAT (1HC,10X,6HENREED,10X,5HCUBIC/11X,F6.3,5X,1HX,1P4E15.4/22X,
11HY,1P4E15.4)
  END

```

\*IBFIC WPNCH    DEBUG

```
SUBROUTINE WPNCH
COMMON /SS/ NBDY1,NBCDY2,TYPEDY,NBCYS
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SCN(500),PIO180
COMMON /PWRT/ IFLAG,NDY4,PRCG,TITLE(9),BODIES(4),IDENT,YLO(25),YH
1I(25),NDY(25),XRAK(25),NBDPTS(5),NC6,NRAKES
DIMENSION YCOFF(200), XOFF(200), FI(500)
COMMON /NNSD/ NNSD,NSDBDY(10)
DATA BODYC/6H-BODY /,IFLAG1/4H 111/,IFLAG2/4H 1 1/,T22Y/6H 22Y/,
1IFLG2A/1H /,IFLG2B/1H1/
```

```
C
C IF YLO AND YHI ARE READ IN AS ZERO,CALCULATE THEM FOR THAT RAKE
C (FOR HUB AND SHROUD CASES ONLY)    1/4/73
C
```

```
C FIND HIGHLIGHT ON THE SHROUD
C
```

```

NB=NBDPTS(1)+1
NE=NBDPTS(2)
DO 2 I=NE,NE
IF (XCN(I+1).LT.XCN(I)) GO TO 2
JMIN=I
GO TO 4
2 CONTINUE
4 DO 6 I=1,NE
6 FI(I)=I
NCOFF=0
DO 16 I=1,NRAKES
NLC=NCOFF+1
NCOFF=NLC+NDY(I)
ENDY=NDY(I)
IF (YHI(I).EQ.0.0.OR.YLO(I).EQ.0.0) GO TO 8
GO TO 12
8 IF (YHI(I).NE.0.0) GO TO 10
CALL SINIP (XCN(NB),YCN(NB),JMIN-NB+1,XRAK(I),YH)
CALL SINIP (XCN(NB),FI(NB),JMIN-NB+1,XRAK(I),FII)
IF=FII
DS=SQRT((XCN(IF)-XCN(IF+1))**2+(YCN(IF)-YCN(IF+1))**2)
YHI(I)=YH-DS
10 IF (YLO(I).NE.0.0.OR.XRAK(I).LT.XCN(1)) GO TO 12
CALL SINIP (XCN,YCN,NBDPTS(1),XRAK(I),YL)
CALL SINIP (XCN,FI,NBDPTS(1),XRAK(I),FII)
IF=FII
DS=SQRT((XCN(IF)-XCN(IF+1))**2+(YCN(IF)-YCN(IF+1))**2)
YLO(I)=YL+DS
12 DYI=(YHI(I)-YLO(I))/ENDY
DO 14 J=NLC,NCOFF
DJM=J-NLC
XCOFF(J)=XRAK(I)
YCOFF(J)=YLO(I)+DYI*DJM
14 CONTINUE
```

```

16  CONTINUE
    NTBDY=NBDYS+NNSD+1
    NLOOP=2
    IF (NBDYS.EQ.3) GO TO 18
    GO TO 20
18  NTBDY=NTBDY+1
    NLOOP=3
20  K=C
    DO 22 I=1,NLOOP
        M=NTBDY-I+1
        IFLAGG=IFLAG2
        IF (M.EQ.NTBDY.AND.NBDYS.EQ.2.OR.NBDYS.EQ.3.AND.M.EQ.3) IFLAGG=IFL
1AG1
        IF (PROG.EQ.T22Y) GO TO 22
        WRITE (6,34) (TITLE(L),L=1,9),M,BODYC,IDENT
        WRITE (6,36) M,IFLAGG,NO6,IDENT
        GO TO 24
22  IFLG22=IFLG2A
        WRITE (6,40) M,IFLG22,(TITLE(L),L=1,7),M,BODYC,IDENT
24  WRITE (6,38) IDENT
        NA=1
        NS=C
        IF (I.NE.1) K=1
        DO 30 J=1,M
            IF (J.GT.NBDYS.AND.NNSD.NE.0) GO TO 26
            NB=NBDPTS(J)
            GO TO 28
26  NS=NS+1
            IF (NS.GT.NNSD) NSBODY(NS)=NBDPTS(NBDYS+1)-NBDPTS(NBDYS)
            NB=NSBODY(NS)+NA-1
28  NP=NB-NA+1
            CALL WRTXY (NP,IDENT,J,K,XON,YON,NA,NB,PROG)
            NA=NB+1
30  CONTINUE
            K=C
            NA=1
            NB=NCOFF
            J=C
            CALL WRTXY (NOFF,IDENT,J,K,XCOFF,YOFF,NA,NB,PROG)
            IF (PROG.NE.T22Y) GO TO 32
            IFLG22=IFLG2B
            WRITE (6,40) M,IFLG22,(TITLE(L),L=1,7),M,BODYC,IDENT
            WRITE (6,42)
32  CONTINUE
        RETURN

C
C  FORMATS
C
C
C
34  FORMAT (1H$,9A6,I1,A6,2X,A6)
36  FORMAT (1H$,I1,A4,I1,56X,A6,11X)
38  FORMAT (1H$,62X,A6,11X)
40  FORMAT (1H$,I1,6H11      ,A1,4X,7A6,I1,A6,1X,A6)
42  FORMAT (1H$,3HC.0,7X,3HO.0,7X,3H90.)
    END

```

\$IBFTC WRTXY.

SUBROUTINE WRTXY (NP,IDENT,J,K,X,Y,NA,NB,PROG)

WRITE X AND Y COORDINATES

DIMENSION X(1), Y(1)

DATA T22Y/6H 22Y/

WRITE (6,8) NP,IDENT

IF (PROG.NE.T22Y) GO TO 4

IF (J.NE.C) GO TO 2

WRITE (6,16) J,K,IDENT

GO TO 6

WRITE (6,14) J,K,IDENT

GO TO 6

WRITE (6,10) J,K,IDENT

IF (K.EQ.1) RETURN

WRITE (6,12) (X(L),L=NA,NB)

WRITE (6,12) (Y(L),L=NA,NB)

RETURN

FORMAT STATEMENTS

FORMAT (1H\$,7X,I3,52X,A6,11X)

FORMAT (1H\$,9X,I1,9X,I1,42X,A6,11X)

FORMAT (1H\$,6F10.6)

FORMAT (1H\$,9X,I1,9X,1H1,9X,I1,32X,A6,11X)

FORMAT (1H\$,9X,I1,19X,I1,32X,A6,11X)

END

\*IBFTC STRT

SUBROUTINE STRAIT (K,ISHR)

C  
C A REGULAR STRAIGHT SEGMENT  
C

COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIC2,DELS1,IHUB  
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /SS/ NBDY1,NBCDY2,TYPBDY,NBCYS  
COMMON /FNST/ NFIRST  
COMMON /NHIGH/ NSPHG,NLAST,XLAST(500)  
KFIRST=K  
XTEST=XIN(2)-XIN(1)  
YTEST=YIN(2)-YIN(1)  
IF (XTEST.EQ.0.0) GO TO 2  
DYDXC=YTEST/XTEST  
ALPHAC=ATAN(YTEST/XTEST)  
GO TO 4  
2 DYDXC=99999.  
ALPHAC=PIC2

C  
C CALCULATE DELSNW  
C

4 STC1=SQR1(XTEST\*\*2+YTEST\*\*2)  
ANDS=STC1/DELS1  
AINDS=AINI(ANDS)  
TEST=ANDS-AINDS  
IF (TEST.GE..5) AINDS=AINDS+1.0  
DELSNW=STC1/AINDS  
DELSNW=ABS(DELSNW)  
DELS1=DELSNW  
IF (YTEST) 6,12,6  
6 IF (XTEST.EQ.0.0) GO TO 18  
DYDXC(K+1)=DYDXC  
ALPHA(K+1)=ALPHAC  
SIGN=1.0  
IF (XTEST.LT.0.0) SIGN=-1.0  
YCN(K+1)=YCN(K)+SIGN\*DELSNW\*SIN(ALPHA(K+1))  
IF (NSPHG.EQ.0) GO TO 8  
XCN(K+1)=XCN(NLAST-1)  
NLAST=NLAST-1  
GO TO 10  
8 XCN(K+1)=XCN(K)+SIGN\*DELSNW\*COS(ALPHA(K+1))  
10 SON(K+1)=SON(K)+SQRT((XCN(K+1)-XCN(K))\*\*2+(YCN(K+1)-YCN(K))\*\*2)  
CAPPA(K+1)=0.0  
IF (XTEST.LT.0.0.AND.XCN(K+1).LE.XIN(2).GR.XTEST.GT.0.0.AND.XCN(K+  
11).GE.XIN(2)) GO TO 20  
IF (ABS(XCN(K+1)-XIN(2)).LE.1.0E-4\*DELS.AND.ABS(YCN(K+1)-YIN(2)).L  
1E.1.0E-4\*DELS) GO TO 20  
K=K+1  
GO TO 6



```

12  DYDXC(K+1)=0.0
    ALPHA(K+1)=0.0
    SIGN=1.0
    IF (XTEST.LT.0.0) SIGN=-1.0
    IF (NSPHG.EQ.0) GO TO 14
    XCN(K+1)=XCN(NLAST-1)
    NLAST=NLAST-1
    GO TO 16
14  XCN(K+1)=XCN(K)+SIGN*DELSNW
16  YCN(K+1)=YCN(K)
    SCN(K+1)=SCN(K)+SQRT((XCN(K+1)-XCN(K))**2+(YCN(K+1)-YCN(K))**2)
    CAPPA(K+1)=0.0
    IF (XTEST.LT.0.0.AND.XCN(K+1).LE.XIN(2).OR.XTEST.GT.0.0.AND.XCN(K+
11).GE.XIN(2)) GO TO 20
    IF (ABS(XCN(K+1)-XIN(2)).LE.1.0E-4*DELS.AND.ABS(YCN(K+1)-YIN(2)).L
1E.1.0E-4*DELS) GO TO 20
    K=K+1
    GO TO 12
18  DYDXC(K+1)=99999.
    ALPHA(K+1)=PI02
    SIGN=1.0
    IF (YTEST.LT.0.0) SIGN=-1.0
    XCN(K+1)=XCN(K)
    YCN(K+1)=YCN(K)+SIGN*DELSNW
    SON(K+1)=SCN(K)+SQRT((XCN(K+1)-XCN(K))**2+(YCN(K+1)-YCN(K))**2)
    CAPPA(K+1)=0.0
    IF (YTEST.LT.0.0.AND.YCN(K+1).LE.YIN(2).OR.YTEST.GT.0.0.AND.YCN(K+
11).GE.YIN(2)) GO TO 20
    IF (ABS(XCN(K+1)-XIN(2)).LE.1.0E-4*DELS.AND.ABS(YCN(K+1)-YIN(2)).L
1E.1.0E-4*DELS) GO TO 20
    K=K+1
    GO TO 18
20  K=K+1
    GO 22 KAL=KFIRST,K
22  ALPHA(KAL)=ALPHA(KAL)/PI0180
    RETURN
    END

```

SIBFIC CUBIC.

SLERCUTINE CUBIC (K)

FIT A CUBIC BETWEEN 2 STRAIGHT LINES -- RESTRICTION -- THE STRAIGHT  
LINES CANNOT BE VERTICAL

DIMENSION AA(4,4), BB(4)  
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIC2,DELS1,IHUB  
COMMON /FCR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500)  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /SS/ NBDY1,NBCDY2,TYPPDY,NBCYS  
DELSIN=DELS1  
DELS=DELS1  
KCLNT=C  
K=K-1  
KSTART=K  
X2=XIN(2)  
X3=XIN(3)  
Y2=YIN(2)  
Y3=YIN(3)  
SLCP2=(YIN(4)-Y3)/(XIN(4)-X3)

SETUP 4 X 4 MATRIX OF COEFFICIENTS

AA(1,1)=1.C  
AA(1,2)=>2  
AA(1,3)=>2\*X2  
AA(1,4)=>2\*\*3  
AA(2,1)=C.C  
AA(2,2)=1.C  
AA(2,3)=2.C\*X2  
AA(2,4)=3.C\*X2\*\*2  
AA(3,1)=1.C  
AA(3,2)=>3  
AA(3,3)=>3\*\*2  
AA(3,4)=>3\*\*3  
AA(4,1)=C.C  
AA(4,2)=1.C  
AA(4,3)=2.C\*X3  
AA(4,4)=3.C\*X3\*\*2  
DO 2 II=1,4  
DEBLC(AA(II,JJ),JJ=1,4)  
CONTINUE

SETUP VECTOR OF ORIGINAL CONSTANTS -- BB

BB(1)=Y2  
BB(2)=(Y2-YIN(1))/(X2-XIN(1))  
BB(3)=Y3  
BB(4)=(YIN(4)-Y3)/(XIN(4)-X3)  
DEBLC(BB(I),I=1,4)

```

NSIM=4
KSIM=0
CALL SIMC (AA,BB,NSIM,KSIM)
D=BB(1)
C=BB(2)
A=BB(4)
C=BB(2)
B=BB(3)
4 K=KSTART
  KCOUNT=KCOUNT+1
  XCN(K+1)=XIN(2)
  YCN(K+1)=YIN(2)
  DYDXC(K+1)=3.0*A*XCN(K+1)**2+2.0*B*XCN(K+1)+C
  CAPPA(K+1)=(6.0*A*XCN(K+1)+2.0*B)/((1.0+DYDXC(K+1)**2)**1.5)
  ALPHA(K+1)=ATAN(DYDXC(K+1))
  DS=DELS/(1.0+.2*TANH(ABS(CAPPA(K+1))))
6 K=K+1
  DXKP1=DS/(SQRT(1.0+DYDXC(K)))
  IF (XIN(3).LT.XIN(2)) DXKP1=-DXKP1
  XCN(K+1)=XCN(K)+DXKP1
  YON(K+1)=A*XCN(K+1)**3+B*XCN(K+1)**2+C*XCN(K+1)+C
  DYDXC(K+1)=3.0*A*XCN(K+1)**2+2.0*B*XCN(K+1)+C
  CAPPA(K+1)=(6.0*A*XCN(K+1)+2.0*B)/((1.0+DYDXC(K+1)**2)**1.5)
  DS=DELS/(1.0+.2*TANH(ABS(CAPPA(K+1))))
  ALPHA(K+1)=ATAN(DYDXC(K+1))
  SCN(K+1)=SCN(K)+SQRT((XCN(K+1)-XCN(K))**2+(YON(K+1)-YON(K))**2)
  IF (SLOP2.GT.1.0) GO TO 8
  IF (XIN(4).GE.X3.AND.XCN(K+1).GT.X3) GO TO 10
  IF (XIN(4).LT.X3.AND.XCN(K+1).LE.X3) GO TO 10
  GO TO 6
8 IF (YIN(4).GE.Y3.AND.YON(K+1).GT.Y3) GO TO 10
  IF (YIN(4).LT.Y3.AND.YON(K+1).LE.Y3) GO TO 10
  GO TO 6
10 IF (KOUNT.GT.100) GO TO 20
  DELSS=DELS
  DSTEST=((XCN(K+1)-XIN(3))**2+(YON(K+1)-YIN(3))**2)**.5
  IF (ABS(DS-DSTEST).LT..01*DS) GO TO 12
  IF (DSTEST.LT..01*DS) GO TO 14
  IF (DSTEST-.5*DS) 18,16,16
12 K=K-1
14 XCN(K+1)=XIN(3)
  YCN(K+1)=YIN(3)
  GO TO 20
16 DELS=DELS+(DS-DSTEST)/FLOAT(K-1-KSTART)
  IF (KOUNT.GE.10) DELS=(DELS+DELSS)/2.0
  GO TO 4
18 DELS=DELS-DSTEST/FLOAT(K-KSTART)
  IF (KOUNT.GE.10) DELS=(DELS+DELSS)/2.0
  GO TO 4
20 DELS1=DS*1.2
  IF (DELS1.GT.DELS) DELS1=DELS
  WRITE (6,24) KOUNT,A,B,C,D
  WRITE (6,26) DELSIN,DELS,DELS1,DSTEST
  KEND=K+1
  KSTART=KSTART+1
  DO 22 I=KSTART,KEND
    ALPHA(I)=ALPHA(I)/PIC180
22 CONTINUE
  RETURN
C
C
24 FORMAT (1HC,2X,14,2X,10HITERATIONS,2X,4HA = ,1PE12.5,2X,4HB = ,1PE
112.5,2X,4HC = ,1PE12.5,2X,4HD = ,1PE12.5)
26 FORMAT (3X,10HDELS IN = ,F8.5,3X,7HDELS = ,F8.5,3X,11HDELS OUT = ,
1F8.5,3X,9HDSTEST = ,F8.5)
  ENC

```

\$IBF1C FNSFB

SUBROUTINE FNSTRH (K)

C  
C  
C

FINAL STRAIGHT SEGMENT ON THE HUB AND SHROUD

COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIO2,DELS1,IHUB  
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /SS/ NBDY1,NBCDY2,TYPBDY,NBCYS  
COMMON /FNST/ NFIRST  
NFIRST=K  
DS=DELS1  
DELSTR=DELSMX  
YTEST=YIN(2)-YIN(1)  
XTEST=XIN(2)-XIN(1)  
ASIGN=1.  
IF (XTEST.LT.0.0) ASIGN=-1.0  
ISTAR=0  
SSEG=SQRT(XTEST\*\*2+YTEST\*\*2)  
IF (XTEST.EQ.0.0) GO TO 2  
IF (YTEST.EQ.0.0) GO TO 4  
DYDXC=YTEST/XTEST  
ALPHAC=ATAN(YTEST/XTEST)  
SINAL=SIN(ALPHAC)  
COSAL=COS(ALPHAC)  
GO TO 6  
2 DYDXC=SIGN(99999.,YTEST)  
ALPHAC=SIGN(PIO2,YTEST)  
SINAL=1.  
COSAL=0.  
GO TO 6  
4 DYDXC=0.  
ALPHAC=0.0  
SINAL=0.  
COSAL=1.  
6 DYDXC(K+1)=DYDXC  
ALPHAC(K+1)=ALPHAC  
IF (DS.GT.DELSMX) GO TO 8  
GO TO 16  
8 IF (ISTAR.NE.0) GO TO 16  
DSLAST=DS  
XCN(K+1)=XCN(K)  
YCN(K+1)=YCN(K)  
ICOUNT=C  
10 XSAVE=XCN(K+1)-XIN(1)  
YSAVE=YCN(K+1)-YIN(1)  
SSTAR=SQRT(XSAVE\*\*2+YSAVE\*\*2)  
ASTAR=(SSEG-SSTAR)/DELSTR  
ATEST=ASTAR-FLOAT(IFIX(ASTAR))  
IF (ATEST.GT..5) ASTAR=ASTAR+1.0  
NSTAR=IFIX(ASTAR)

```

DS=(SSEG-SSTAR)/FLOAT(NSTAR)
ISTAR=1
IF (DS.GT.DSLAST.CR.ASTAR.EQ.0) GO TO 12
IF (ICOUNT.GT.0) K=K+1
GO TO 16
12 K=K-1
IF (K.GT.NFIRST) GO TO 14
K=NFIRST
CALL STRAIT (K,C)
K=K-1
GO TO 18
14 DSLAST=SQRT((XCN(K-1)-XCN(K))**2+(YCN(K-1)-YCN(K))**2)*1.2
DELSTR=DSLAST
ICCOUNT=ICCOUNT+1
GO TO 16
16 XCN(K+1)=XCN(K)+ASIGN*DS*COSAL
YCN(K+1)=YCN(K)+ASIGN*DS*SINAL
SCN(K+1)=SCN(K)+SQRT((XCN(K+1)-XCN(K))**2+(YCN(K+1)-YCN(K))**2)
CAPPA(K+1)=C.0
IF (ABS(XCN(K+1)-XIN(2)).LE..001*DS.AND.XTEST.NE.0.0) GO TO 18
IF (ABS(YCN(K+1)-YIN(2)).LE..001*DS.AND.XTEST.EQ.0.0) GO TO 18
K=K+1
IF (ISTAR.EQ.0) DS=DS*1.2
GO TO 6
18 DELS1=DELS
XCN(K+1)=XIN(2)
YCN(K+1)=YIN(2)
NDCY1=K+1
K=K+1
DO 20 KAL=NFIRST,K
20 ALPHA(KAL)=ALPHA(KAL)/PI0180
RETURN
END

```

\*IBFIC FRSTS

SUBROUTINE FRSTSH (K)

FIRST STRAIGHT SEGMENT SHROUD

IF THERE IS NO HUB INTERCHANGE POINTS (X1,Y1) AND (X2,Y2)  
AND TREAT LIKE FINAL STRAIGHT SECTION ON THE HUB,  
THEN REVERSE XCN AND YCN ARRAYS

```
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIQ2,DELS1,IHUB
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SON(500),PIQ180
COMMON /SS/ NBDY1,NBDY2,TYPBDY,NBCYS
COMMON /FNST/ NFBST
DIMENSION XA(2),YA(2),DSV(500),ASV(500),XSV(500),YSV(500),SS
1W(500)
SON(K)=0.0
IF (IHUB.EQ.1) GO TO 8
DO 2 I=1,2
  XA(I)=XIN(I)
  YA(I)=YIN(I)
  XIN(1)=XA(2)
  XIN(2)=XA(1)
  YIN(1)=YA(2)
  YIN(2)=YA(1)
  NFB2=K
  YCN(K)=YIN(1)
  XCN(K)=XIN(1)
  CALL FNSTRF (K)
  KSV=K
  DO 4 I=NFB2,KSV
    KSR=KSV+1-I
    DSV(KSR)=DYDXO(I)
    ASV(KSR)=ALPHA(I)
    XSV(KSR)=XCN(I)
    YSV(KSR)=YCN(I)
    SSV(KSR)=SON(I)
    DO 6 I=NFB2,KSV
      DYDXO(I)=DSV(I)
      ALPHA(I)=ASV(I)
      XCN(I)=XSV(I)
      YCN(I)=YSV(I)
      SON(I)=SSV(I)
      CAPPA(I)=0.0
      CCNTINUE
    DELS1=ABS(SON(KSV)-SON(KSV-1))
    NBDY1=0
    RETURN
```

IF THERE IS A HUB, USE X VALUES FROM FINAL STRAIGHT

```

C      SECTION ON THE HLB FOR FIRST STRAIGHT SECTION ON
C      SHRCLD
C
8      XTEST=XIN(1)-XIN(2)
      YTEST=YIN(1)-YIN(2)
      IF (XTEST.EQ.0.0) GO TO 10
      DYDXC=YTEST/XTEST
      ALPHAC=ATAN2(YTEST,XTEST)
      GO TO 12
10     DYDXC=99999.
      ALPHAC=PI/2
12     K=K-1
      NBDC=NBDY1
      IF (IYPBDY.EQ.3.0.AND.NBDYS.EQ.3) NBDC=NBDY2
      DO 18 I=NFIRST,NBDC
      KEEP=NBDC+NFIRST-I
      XCN(K+1)=XCN(KEEP)
      DYDXC(K+1)=DYDXC
      ALPHA(K+1)=ALPHAC
      IF (I.EQ.NFIRST) GO TO 14
      YCN(K+1)=YCN(K)+(XON(K+1)-XON(K))*DYDXC
      SCN(K+1)=SCN(K)+(XON(K)-XON(K+1))*COS(ALPHAC)
      GO TO 16
14     YCN(K+1)=YIN(1)+(XON(K+1)-XIN(1))*DYDXC
16     CAPPA(K+1)=0.0
      ALPHA(K+1)=ALPHA(K+1)/PI/180
      K=K+1
18     CONTINUE
      DELS1=SCN(K)-SCN(K-1)
      RETURN
      END

```

\$IBFTC LEM1

SUBROUTINE LEM (K)

C  
C  
C

SUBROUTINE TO CALCULATE POINTS ON A LEMNISCATE

COMMON /FCR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180

COMMON /IS/ NBDY1,NBCDY2,TYPEOY,NBCYS

COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIO2,DELS1,IHUR

DELSIN=DELS1

K=K-1

KSTART=K

DELS=DELS1

THETMX=ATAN(ABS((YIN(3)-YIN(2))/(XIN(3)-XIN(2))))

A=SQRT(((XIN(3)-XIN(2))\*\*2+(YIN(3)-YIN(2))\*\*2)/(2.0\*SIN(2.0\*THETMX  
1)))

KOUNT=0

IF (YIN(1).EQ.YIN(2)) GO TO 10

IF (XIN(1).EQ.XIN(2)) GO TO 2

SLOPE=(YIN(2)-YIN(1))/(XIN(2)-XIN(1))

ARCT=-TAN(SLOPE)

GO TO 4

2 SLOPE=99999.

ARCT=-PI/2

4 DO 6 IROT=1,3

XN=XIN(IROT)

XIN(IROT)=XN\*COS(AROT)-YIN(IROT)\*SIN(AROT)

6 YIN(IROT)=XN\*SIN(AROT)+YIN(IROT)\*COS(AROT)

8 K=KSTART

10 XCN(K+1)=XIN(2)

YCN(K+1)=YIN(2)

CAPPA(K+1)=0.0

DYDXO(K+1)=0.0

ALPHA(K+1)=0.0

KOUNT=KOUNT+1

DSSAVE=DELS

DS=DELS

DTHET=DS\*\*2/A\*\*2

THET=DTHET\*.5

12 R=A\*SQRT(2.0\*SIN(2.0\*THET))

DSCHEK=R\*CCS(THET)

IF (DSCHEK.GT.1.1\*DS) GO TO 14

IF (DSCHEK.LT..9\*DS) GO TO 16

DELS=DS

GO TO 18

14 THET=THET-.02\*DTHET

GO TO 12

16 THET=THET+.02\*DTHET

GO TO 12

18 K=K+1

20 R=A\*SQRT(2.0\*SIN(2.0\*THET))



```

XCN(K+1)=XIN(2)-R*COS(THET)
YCN(K+1)=YIN(2)+R*SIN(THET)
SCN(K+1)=SCN(K)+SQRT(((XCN(K+1)-XCN(K))**2+(YCN(K+1)-YCN(K))**2)
IF (ABS(SCN(K+1)-SCN(K)).GT.1.05*DS) GO TO 22
IF (ABS(SCN(K+1)-SCN(K)).LT..95*DS) GO TO 24
GO TO 26
22 THET=THET+.02*DTHET
GO TO 20
24 THET=THET+.02*DTHET
GO TO 20
26 DYDXC(K+1)=-TAN(3.0*THET)
ALPHA(K+1)=-3.0*THET
CAPPA(K+1)=3.0*SQRT(SIN(2.0*THET)/2.0)/A
DS=DELS/SQRT(1.0+ABS(CAPPA(K+1)))
IF (ABS(DS-DSSAVE).GT..25*DSSAVE) DS=DSSAVE+SIGN(.25*DSSAVE,DS-DSS
1AVE)
DSSAVE=DS
DTHET=DS*SQRT(SIN(2.0*THET)/2.0)/A
THET=THET+DTHET
IF (THET.LE.THETMX) GO TO 18
IF (KOUNT.GT.50) GO TO 36
DSTEST=((XCN(K+1)-XIN(3))**2+(YCN(K+1)-YIN(3))**2)**.5
IF (DSTEST.GT.DS) GO TO 34
IF (DSTEST.LT..0001*DS) GO TO 28
IF (DSTEST-.5*DS) 32,32,30
28 YCN(K+1)=YIN(3)
XCN(K+1)=XIN(3)
GO TO 36
30 DELS=DELS-DSTEST/FLOAT(K+1-KSTART)
GO TO 8
32 DELS=DELS+DSTEST/FLOAT(K+1-KSTART)
GO TO 8
34 DELS=.8*DELS
GO TO 8
36 DELS1=DS*1.2
IF (DELS1.GT.DELS) DELS1=DELS
WRITE (6,44) KOUNT,THETMX,A
WRITE (6,46) DELSIN,DELS,DELS1,DSTEST
KENC=K+1
KSTART=KSTART+1
IF (YIN(2).EQ.YIN(1)) GO TO 40
DO 38 KRCT=KSTART,KEND
XN=XCN(KRCT)
XCN(KROT)=XN*COS(ARCT)+YCN(KRCT)*SIN(ARCT)
YCN(KROT)=YCN(KRCT)*COS(ARCT)-XN*SIN(ARCT)
ALPHA(KROT)=ALPHA(KRCT)-ARCT
DYDXC(KROT)=TAN(ALPHA(KROT))
38 CONTINUE
40 DO 42 KAL=KSTART,KENC
42 ALPHA(KAL)=ALPHA(KAL)/PIC180
RETURN
C
C
44 FORMAT (3X,I3,2X,I3HITERATIONS---,3X,I3HTHETMXCALC = ,F10.5,3X,8HA
1CALC = ,F10.5)
46 FORMAT (2X,10HDELS IN = ,F8.5,3X,7HDELS = ,F8.5,3X,11HDELS OUT = ,
1F8.5,3X,5HDSTEST = ,F8.5)
ENC

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# \$IBFTC ELLIPS

## SUBROUTINE ELIPSE (K)

THIS SUBROUTINE FITS A SEGMENT OF AN ELLIPSE TO TWO ARBITRARILY  
ORIENTED STRAIGHT LINES NOT MORE THAN 90 DEGREES APART

COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIO2,DELS1,IHUB  
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500  
1),ALPHA(500),CAPPA(500),SON(500),PIO180  
COMMON /SS/ NBDY1,NBCDY2,TYPEDY,NBCYS

TRANSLATE INPUT BREAK POINTS SO THAT POINT NO. 2 BECOMES  
THE ORIGIN

DELSIN=DELS1  
KOUNT=0  
DELS=DELS1  
PI=3.141592653  
K=K-1  
KSTART=K  
X2=XIN(2)  
Y2=YIN(2)  
DO 2 I=1,4  
XIN(I)=XIN(I)-X2  
YIN(I)=YIN(I)-Y2

ROTATE THE TRANSLATED BREAK POINTS SO THAT THE SLOPE OF THE  
FIRST STRAIGHT LINE IS ZERO

IF (XIN(2).NE.XIN(1)) GO TO 4  
SLOPE=99999.  
PHI=-PIO2  
IF (YIN(1).GT.YIN(2)) PHI=PI+2  
GO TO 6  
SLOPE=(YIN(2)-YIN(1))/(XIN(2)-XIN(1))  
PHI=ATAN(SLOPE)  
IF (XIN(1).LT.XIN(2)) PHI=PI+ATAN(SLOPE)  
DO 8 I=1,4  
XA=XIN(I)  
XIN(I)=XA\*CCS(PHI)+YIN(I)\*SIN(PHI)  
YIN(I)=-XA\*SIN(PHI)+YIN(I)\*CCS(PHI)

DETERMINE THE ELLIPSE

IF (XIN(4).NE.XIN(3)) GO TO 10  
B=YIN(3)  
A=ABS(XIN(3))  
PHIAB=PI+2  
GO TO 12  
SLOP2=(YIN(4)-YIN(3))/(XIN(4)-XIN(3))  
IF (SLOP2.LE.2.0\*YIN(3)/XIN(3)) GO TO 52

```

C3=XIN(3)*SLOP2/YIN(3)
PHIAB=2.*ATAN(SQRT((C3-2.0)/C3))
A=-XIN(2)/SIN(PHIAB)
B=YIN(3)/(1.0-COS(PHIAB))
12 THETMX=PHIAB-PI02
  THETMXD=THETMX/PI0180
  WRITE (6,54) A,B,XIN(1),YIN(1),PHI,THETMXC
C
C INITIALIZE THE FIRST POINT ON THE ELLIPSE
C
14 K=KSTART
  XCN(K+1)=XIN(2)
  YCN(K+1)=YIN(2)
  CAPPA(K+1)=-B/(A**2)
  ALPHA(K+1)=0.0
  DYDXC(K+1)=0.0
  KOUNT=KOUNT+1
  THET=-PI02
  DSSAVE=DELS
  DS=DELS/(1.0+.2*TANH(ABS(CAPPA(I))))
  DTHET=DS/ABS(A)
  THET=THET+DTHET
C
C GENERATE THE POINTS ON THE ELLIPSE
C
16 K=K+1
18 XCN(K+1)=-A*COS(THET)
  XCN(K+1)=B*(1.0+SIN(THET))
  SCN(K+1)=SCN(K)+SQRT((XCN(K+1)-XCN(K))**2+(YCN(K+1)-YCN(K))**2)
  IF (ABS(SCN(K+1)-SCN(K)).GT.1.05*DS) GO TO 20
  IF (ABS(SCN(K+1)-SCN(K)).LT..95*DS) GO TO 22
  GO TO 24
20 THET=THET-.02*DTHET
  GO TO 18
22 THET=THET+.02*DTHET
  GO TO 18
24 IF (THET.EQ.0.0) GO TO 26
  DYDXC(K+1)=B*CTAN(THET)/A
  ALPHA(K+1)=ATAN(DYDXC(K+1))
  GO TO 28
26 DYDXC(K+1)=99999.
  ALPHA(K+1)=PI02
28 CAPPA(K+1)=-A*B/(B*B*COS(THET)**2+A*A*SIN(THET)**2)**1.5
  DS=DELS/(1.0+.2*TANH(ABS(CAPPA(I))))
  IF (ABS(DS-DELS).GT..20*DELS) DS=DELS+SIGN(.20*DELS,DS-DELS)
  DSSAVE=DS
30 DTHET=DS/SQRT(B*B*COS(THET)**2+A*A*SIN(THET)**2)
  DTS=DTHET
  THET=THET+DTHET/2.0
  DTHET=DS/SQRT(B*B*COS(THET)**2+A*A*SIN(THET)**2)
  IF (ABS(DTHET-DTS).LT..001*DTS) GO TO 32
  GO TO 30
32 IF (THET.LE.THETMX-DTHET/2.0) GO TO 16
  IF (KOUNT.GT.100) GO TO 44
  DELSS=DELS
  DSTEST=((XCN(K+1)-XIN(3))**2+(YCN(K+1)-YIN(3))**2)**.5

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      IF (ABS(DS-DSTEST).LT..01*DS) GO TO 34
      IF (DSTEST.GT.DS) GO TO 42
      IF (DSTEST.LT..01*DS) GO TO 36
      IF (DSTEST-.5*DS) 40,34,38
34    K=K+1
36    XCN(K+1)=XIN(3)
      YCN(K+1)=YIN(3)
      GO TO 44
38    DELS=(FLOAT(K+1-KSTART)*DELS+DSTEST)/FLOAT(K+2-KSTART)
      IF (KOUNT.GE.10) DELS=(DELS+DELSS)/2.0
      GO TO 14
40    DELS=DELS+DSTEST/FLOAT(K+2-KSTART)
      IF (KOUNT.GE.10) DELS=(DELS+DELSS)/2.0
      GO TO 14
42    DELS=.8*DELS
      GO TO 14
44    DELS1=DS*1.2
      IF (DELS1.GT.DELS) DELS1=DELS
      WRITE (6,56) KOUNT
      WRITE (6,60) DELSIN,DELS,DELS1,DSTEST
      KEND=K+1
      DEBUG(XCN(1),YCN(1),I=KSTART,KEND),PHI
      KSTART=KSTART+1
C
C    ROTATE AND TRANSLATE BACK
C
      DO 50 KRCT=KSTART,KEND
      XA=XCN(KRCT)
      XCN(KRCT)=XA*COS(PHI)-YCN(KRCT)*SIN(PHI)+X2
      YCN(KRCT)=XA*SIN(PHI)+YCN(KRCT)*COS(PHI)+Y2
      ALPHA(KRCT)=ALPHA(KRCT)+PHI
      IF (ALPHA(KRCT).EQ.PID2) GO TO 46
      DYDXC(KRCT)=TAN(ALPHA(KRCT))
      GO TO 48
46    DYDXG(KRCT)=99999.
48    ALPHA(KRCT)=ALPHA(KRCT)/PID180
50    CONTINUE
      RETURN
52    WRITE (6,58) SLOP2,XIN(3),YIN(3)
      STOP
C
C
54    FORMAT (1HC,10X,4HA =,1PE10.3,5X,4HR =,1PE10.3,5X,5HXO =,1PE10.
13,5X,7HYC =,1PE10.3/9X,7HPHI =,1PE10.3,5X,9HTHETMX =,1PE10.3
2.)
56    FORMAT (11X,13,2X,13HITERATIONS---)
58    FORMAT (1HC,10X,42HCOMBINATION OF SLOPE, X , Y NOT COMPATIBLE/5X,9
1HSLOPE2 =,F7.3,3X,9HXIN(3) =,F7.3,3X,9HYIN(3) =,F7.3)
60    FORMAT (11X,10HDELS IN =,F8.5,3X,7HDELS =,F8.5,3X,11HDELS OUT =
1,F8.5,3X,9HDSTEST =,F8.5)
      END

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# \*IBFTC PRLPS

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SUBROUTINE PRELPS (KCODE,KAT,IA,K1,K2)
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIQ2,DELS1,IHUB
COMMON /FCR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SON(500),PIQ180
COMMON /SPREP/ KPREP
KPREP=1
IF (KAT.EQ.1) GO TO 20
KIC=KODE
X1=XIN(1)
Y1=YIN(1)
IF (IA.EQ.5) GO TO 2
XC=XIN(4)
YC=YIN(4)
GO TO 4
2 XC=XIN(5)
YC=YIN(5)
4 DO 14 IB=1,IA
GO TO (6,8,10,12,8,12),KODE
6 YIN(IB)=YIN(IA)-(YIN(IB)-YIN(IA))
GO TO 14
8 XIN(IB)=XIN(1)-(XIN(IB)-XIN(1))
GO TO 14
10 YIN(IB)=YIN(1)-(YIN(IB)-YIN(1))
GO TO 14
12 XIN(IB)=XIN(IA)-(XIN(IB)-XIN(IA))
14 CONTINUE
DEBUG(XIN(I),I=1,IA),(YIN(I),I=1,IA),KODE
IF (KODE.EQ.5) GO TO 16
IF (KODE.EQ.6) GO TO 18
RETURN
16 KCODE=1
GO TO 4
18 KCODE=3
GO TO 4
20 DO 32 IB=K1,K2
GO TO (22,24,26,28,22,26),KIC
22 YCN(IB)=YC-(YCN(IB)-YC)
GO TO 30
24 XCN(IB)=X1-(XCN(IB)-X1)
GO TO 30
26 YCN(IB)=Y1-(YCN(IB)-Y1)
GO TO 30
28 XCN(IB)=XC-(XCN(IB)-XC)
30 DYDXO(IB)=-DYDXO(IB)
32 CONTINUE
DEBUG(XCN(I),I=K1,K2),(YCN(I),I=K1,K2),KID,K1,K2
IF (KID.EQ.5) GO TO 34
IF (KID.EQ.6) GO TO 36
RETURN
34 KIC=2
GO TO 20
36 KIC=4
GO TO 20
END

```

\*IBFTC TEST.

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SUBROUTINE TEST (IA)
COMMON /MAIN/ XIN(10),YIN(10),DELSMX,PIO2,DELS1,IHUP
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SON(500),PIO180
COMMON /SPREP/ KPREP
M=IA-1
IF (XIN(2).EQ.XIN(1)) GO TO 2
SLP1=(YIN(2)-YIN(1))/(XIN(2)-XIN(1))
GO TO 4
2 SLP1=99999.
IF (YIN(2).GT.YIN(M).AND.XIN(2).LT.XIN(M)) GO TO 10
4 IF (XIN(1).EQ.XIN(M)) GO TO 6
SLP2=(YIN(M)-YIN(1))/(XIN(M)-XIN(1))
GO TO 8
6 SLP2=99999.
C
C ROTATION ONLY
C
C IF (SLP1.GT.SLP2) RETURN
C
C MIRROR INTO XIN(1)
C
10 CALL PRELPS (2,C,IA)
RETURN
END

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\*IBFTC SMIR DECK,LIST

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SUBROUTINE MIRROR (K,YCL)
C
C THIS SUBROUTINE MIRRORS THE HUB TO OBTAIN THE POINTS ON SHROUD
C USED FOR 22Y - 2-D INLETS
C
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SON(500),PIO180
COMMON /SS/ NBDY1,NBDY2,TYPEDY,NBDYS
DO 2 J=1,NBDY1
K=K+1
ISTAR=1+2*NBDY1-K
XCN(K)=XCN(ISTAR)
YCN(K)=2.0*YCL-YCN(ISTAR)
CAPPA(K)=-CAPPA(ISTAR)
DYDXO(K)=-DYDXO(ISTAR)
ALPHA(K)=-ALPHA(ISTAR)
SON(K)=SON(ISTAR)
2 CONTINUE
WRITE (6,4) YCL
RETURN
C
4 FORMAT (33H HUB MIRRORED INTO Y CENTERLINE = ,F8.3)
END

```

\*IBFIC SINTP

```
SUBROUTINE SINTP (Z,W,N,X1,Y1)
DIMENSION X(200), Y(200), Z(200), W(200)
DO 2 I=1,N
X(I)=Z(I)
2 Y(I)=W(I)
CALL SORTXY (X,Y,N)
C
DO 4 I=1,N
K=I
IF (X1.GT.X(I)) GO TO 4
IF (X1.EQ.X(I)) GO TO 6
IF (X1.LT.X(I)) GO TO 8
4 CONTINUE
6 Y1=Y(K)
GO TO 10
8 IF (K.EQ.1) GO TO 12
IF (K.EQ.N) K=N-1
W1=(X1-X(K))*(X1-X(K+1))/(X(K-1)-X(K))/(X(K-1)-X(K+1))
W2=(X1-X(K-1))*(X1-X(K+1))/(X(K)-X(K-1))/(X(K)-X(K+1))
W3=(X1-X(K-1))*(X1-X(K))/(X(K+1)-X(K-1))/(X(K+1)-X(K))
Y1=Y(K-1)*W1+Y(K)*W2+Y(K+1)*W3
10 RETURN
12 Y1=C.O
RETURN
END
```

# \$IBFIC SPRCRC

```

SUBROUTINE SUPERC (XBRK,YBRK,ENREED,DELS1,ISTART)
DIMENSION XBRK(5), YBRK(5), XBK1(12), YBK1(12)
EQUIVALENCE (N,EN)
REAL LOGXOA,LOGYOB,N
COMMON /SUPF/ IFLD
COMMON /FOR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500)
1),ALPHA(500),CAPPA(500),SON(500),PIO180
COMMON /SUPN/ XCA,YCB,LOGXOA,LOGYOB
COMMON /NHIGH/ NSPHG,NLAST,XLAST(500),YLAST(500)
COMMON /SPREP/ KPREP
IPI=C
PI=3.14159265
IF (IFLD.EQ.1) DELSHL=DELS1
DELSIN=DELS1
DELS2=DELS1
KOUNT=0
2  I1=ISTART
IF (IFLD.GE.1) DS=DELS2
KOUNT=KOUNT+1
I=ISTART
X41=XBRK(4)
Y41=YBRK(4)
DO 4 J=1,5
XBK1(J+7)=XBRK(J)
YBK1(J+7)=YBRK(J)
4  CONTINUE
DEPUG(XBK1(J),YBK1(J),J=8,12)
IF (XBK1(9).NE.XBK1(8)) GO TO 8
IF (YBK1(8).LT.YBK1(9)) GO TO 6
SLOP=99999.
SINATD=1.0
SLOPE=99999.
ATCYDD=90.
CCSATD=0.0
GO TO 14
6  SLOP=-99999.
SINATD=-1.0
SLOPE=-99999.
ATCYDD=-90.
CCSATD=0.0
GO TO 14
8  SLOP=(YBK1(9)-YBK1(8))/(XBK1(9)-XBK1(8))
SLOPE=ATAN(SLOP)
ATCYDD=SLOPE/PIO180
IF (XBK1(8)-XBK1(9)) 10,12,12
10  SLOPE=PI+SLOPE
ATCYDD=-ATCYDD
IPI=1
12  SINATD=SIN(SLOPE)
CCSATD=CCS(SLOPE)

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```

14  CONTINUE
    XBK(8)=XEK1(8)
    YBK(8)=YEK1(8)
    DO 16 J=9,12
        XP=XBK1(J)-XBK1(8)
        YP=YBK1(J)-YBK1(8)
        XBK(J)=XEK1(8)+XP*COSATD+YP*SINATD
        YBK(J)=YEK1(8)-XP*SINATD+YP*COSATD
16  CONTINUE
    XBK(5)=XEK(8)
    YBK(5)=YBK(8)
    XBK(6)=XEK(9)
    YBK(6)=YEK(9)
    XBK(9)=XEK(10)
    YBK(9)=YBK(10)
    DELS=DELS1
    DSSAVE=DELS
    XTM=XBK1(9)
    YTM=YBK1(9)
    B=YBK(11)-YBK(6)
    TCMEGA=(XBK(12)-XBK(11))/(YBK(12)-YBK(11))
    IF (ABS(TCMEGA).LE..0001) TCMEGA=0.
    OMEGA=ATAN(TCMEGA)
    XC=XBK(6)+B*TCMEGA
    YC=YBK(11)
    A=XC-XBK(11)
    XI9=XO-XEK(9)
    ETA9=YC-YBK(9)
    Y=ETA9
    X=XI9-ETA9*TCMEGA
    BCA=B/A
    IF (ENREED) 18,18,20
18  XCA=X/A
    YCB=Y/B
    LOGXCA=ALOG(XCA)
    LOGYCB=ALOG(YCB)
    CALL FONISC (EN)
    GO TO 22
20  EN=ENREED
22  BCATN=BCA**EN
    IF (KOUNT.NE.1) GO TO 24
    WRITE (6,114) EN,A,B,XO,YO,OMEGA
24  I=1
    ILG=I
    XCN(I)=XCN(11)
    CIGN=1./EN
    BT=B*TCMEGA
    DX1=DELS*COSATD
    XP=XTM-XEK1(8)
    YP=YTM-YEK1(8)
    XI1RGT=XEK1(8)+XP*COSATD+YP*SINATD
    XI=XC-XI1RGT
    Y=YC-YBK(6)
    X=XI-Y*TCMEGA
    IF (X.LT.C.C) X=C.C
    DSM=SON(I)-SON(I-1)

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26  XCATCN=(X/A)**N
    YCBTCN=(Y/B)**N
    XNMCAN=X**(N-1.)/A**N
    YNMCBN=Y**(N-1.)/B**N
    FCFY=XCATCN+YCBTCN-1.
    IF (ABS(FCFY).LE.1.0E-5) GO TO 28
    FPCFY=EN*(YNMCBN-XNMCAN*TOMEGA)
    YNEW=Y-FCFY/FPCFY
    GO TO 30
28  YNEW=Y
30  IF (ABS(Y-YNEW)/YNEW-.1E-4) 34,34,32
32  Y=YNEW
    X=XI-Y*TOMEGA
    GO TO 26
34  X=YNEW
    X=XI-Y*TOMEGA
36  ETA=Y
    DELS=DELS2
    IPN=1
    IF (X.LT.0.0) X=0.0
    XCANM1=(X/A)**(EN-1.)
    YCBNM1=(Y/B)**(EN-1.)
    F1=XCANM1/A
    F2=YCBNM1/B
    F3=TOMEGA*F1
    IF (X.EQ.0.0) GO TO 38
    F1CX=X**(EN-2.)/A**EN
    GO TO 40
38  IF (EN.EQ.2.) F1CX=1.0/(A*A)
    IF (EN.GT.2.) F1CX=0.0
40  IF (Y.EQ.0.0) GO TO 42
    F2CY=Y**(EN-2.)/B**EN
42  DEN=F2-F3
    IF (DEN.NE.0.0) GO TO 44
    DETDXI=99999.
    GO TO 46
44  DETDXI=-F1/DEN
46  CYDXC(IPN)=DETDXI
    CIMEPT=1.-DETDXI*TOMEGA
    IF ((X.EQ.0.0.OR.Y.EQ.0.0).AND.EN.LT.2.) GO TO 48
    G1=(EN-1.)*F1CX*CIMEPT
    SAND1=DEN*G1
    SAND2=F1*((EN-1.)*F2CY*DETDXI-G1*TOMEGA)
    BKT=(1.+DETDXI**2)**1.5
    CAPPA(IPN)=(SAND2-SAND1)/DEN**2/BKT
    GO TO 50
48  CAPPA(IPN)=99999.
50  ALPHA(IPN)=ATAN(CYDXC(IPN))/PI0180
    XCN(IPN)=XC-XI
    YCN(IPN)=YC-ETA
    DY1=DELS*SINATD
    IF (IFLD.GE.1) GO TO 52
    DS=DELS/(1.0+.20*TANH(ABS(CAPPA(I))))
    GO TO 56
52  IF (IFLD.GT.1) GO TO 54
    DS=DS-.05*DS

```

```

54 GO TO 58
   DS=DS
   IF (DS.GT.DELSHL) DS=DELSHL
   GO TO 58
56 IF (ABS(DS-DELS).GT..20*DELS) DS=DELS+SIGN(.20*DELS,DS-DELS)
58 IF (DS.LT..50*DELS2) DS=.50*DELS2
   IF (NSPHG.EQ.0) GO TO 60
   DX1=ABS(XLAST(NLAST)-XLAST(NLAST-1))
   DX11=DX1
   DY1=ABS(YLAST(NLAST)-YLAST(NLAST-1))
   NLAST=NLAST-1
60 IF (ABS(DETOXI)-1.) 70,70,62
62 DY1=DS/SCRT(1.+1./DETOXI**2)
   IF (NSPHG.NE.0) DY1=DX1
64 XTM=YON(1)+DY1
   IF (YTM-YBK(11)) 66,66,86
66 ETA=Y0-YTM
   Y=ETA
C
C STRAIGHT SECTION BETWEEN POINTS 11 AND 12 MUST HAVE SLOPE ABOVE 1
C
C X MAY NOT BE TESTED AGAINST XBK(11)
C
   X=A*(1.-(Y/B)**N)**CIGN
   XI=X+Y*TCMEGA
   XTM=X0-XI
   DX1=XTM-XON(1)
   DELTAS=SCRT(DY1**2+DX1**2)
   IF (DELTAS.GT.1.02*DS.AND.IPN.NE.1.AND.NSPHG.EQ.0) GO TO 68
   GO TO 86
68 DY1=DS*DY1/DELTAS
   GO TO 64
70 DX1=DS/SCRT(1.+DETOXI**2)
   IF (NSPHG.NE.0) DX1=CY1
   IF (NSPHG.NE.0.AND.IPI.EQ.1) DX1=DX11
72 XTM=XON(1)+SIGN(DX1,DETOXI)
   IF (DETOXI.EQ.0.) XTM=XON(1)-DX1
   XI=X0-XTM
   Y=Y0-YON(1)
74 X=XI-Y*TCMEGA
   IF (X.LT.0.0) X=0.0
   XCATCN=(X/A)**N
   XNMCAN=X**N/(N-1.)/A**N
   YNMCBN=Y**N/(N-1.)/B**N
   YOBTCN=(Y/B)**N
   FCFY=XCATCN+YOBTCN-1.
   IF (ABS(FCFY).LE.1.0E-5) GO TO 76
   FPOFY=EN*(YNMCBN-XNMCAN*TOMEGA)
   YNEW=Y-FCFY/FPOFY
   GO TO 78
76 YNEW=Y
78 IF (ABS(Y-YNEW)/YNEW-.1E-4) 82,82,80
80 Y=YNEW
   GO TO 74
82 Y=YNEW

```

```

X=XI-Y*TCMEGA
YTM=YQ-Y
XI=X+Y*TCMEGA
C DY1=YTM-YCN(I-1)
DY1=YTM-YCN(I)
DELTAS=SCRT(DY1**2+DX1**2)
IF (DELTAS.GT.1.02*DS.AND.IPN.NE.1.AND.NSPHG.EQ.0) GO TO 84
GO TO 86
84 DX1=DS*DY1/DELTAS
GO TO 72
86 SON(I)=SON(I-1)+DSM
DSM=DS
IF (NSPHG.NE.0) DS=DX1
IF (ABS(YTM-YBK(11)).LT..001*DS) GO TO 90
I=I+1
IF (YTM-YBK(11)) 36,E8,88
88 IHI=I-1
GO TO 92
90 IHI=I
I=I+1
92 XTM=YBK(11)
DO 108 J=ILQ,IHI
XP=XON(J)-YBK1(8)
YP=YCN(J)-YBK1(8)
XCN(J)=XEK1(8)+XP*COSATD-YP*SINATD
YCN(J)=YEK1(8)+XP*SINATD+YP*COSATD
DELS2=DELS2
IF (J.NE.IHI) GO TO 104
DSTEST=((XCN(IHI)-X4T)**2+(YCN(IHI)-Y4T)**2)**.5
IF (AMOUN1.GT.150) GO TO 104
IF (ABS(DS-DSTEST).LT..1*DS) GO TO 94
IF (CSTEST.LT..01*DS) GO TO 96
IF (IHI.EQ.ILO) GO TO 102
IF (ABS(DELS2-DSTEST).LT..001*DS) GO TO 100
IF (CSTEST.LT..5*DS) GO TO 100
IF (CSTEST.GT..5*DS) GO TO 98
94 IHI=IHI+1
I=I+1
SON(IHI)=SON(IHI-1)+CSTEST
96 XCN(IHI)=X4T
YCN(IHI)=Y4T
GO TO 104
98 DELS2=(FLOAT(IHI-ILO)*DELS2+CSTEST)/FLOAT(IHI+1-ILO)
IF (KOUN1.GE.10) DELS2=(DELS2+DELS2)/2.0
I=ILO-1
GO TO 2
100 DELS2=DELS2+DSTEST/FLOAT(IHI-ILO)
IF (KOUN1.GE.10) DELS2=(DELS2+DELS2)/2.0
I=ILO-1
GO TO 2
102 DELS2=.8*DELS2
I=ILO-1
GO TO 2
104 ALPHA(J)=ALPHA(J)-ATCYDD
IF (ABS(ABS(ALPHA(J))-90.).LE.1.0E-4) GO TO 106
DYEXCH(J)=TAN(ALPHA(J)*PI/180)

```

```

GO TO 108
106 DYDX(J)=SIGN(999.,ALPHA(J))
108 CONTINUE
IF (KOUNT.GT.150) WRITE (6,116) (XBRK(I),YBRK(I),I=1,5)
DELS1=DS
IF (IFLD.EQ.0) DELS1=1.1*DS
IF (DELS1.GT.DEELS2) DELS1=DELS2
GO 112 J=ILO,IHI
IF (J.EQ.1) GO TO 110
SON(J)=SON(J-1)+SQRT((XON(J)-XON(J-1))**2+(YON(J)-YON(J-1))**2)
GO TO 112
110 SON(J)=0.0
112 CONTINUE
WRITE (6,118) KOUNT
WRITE (6,120) DELSIN,DELS2,DELS1,DSTEST
RETURN
C
C
114 FORMAT (1X/4X4HN = E16.8,4X4HA = E16.8,7X4HB = E16.8/3X5HXO = E16.
18,3X5HYO = E16.8,3X8HOMEGA = E16.8/1X)
116 FORMAT (1HC,60HTHIS SET OF DATA EXCEEDED 150ITERATIONS CALCULATION
1S STOPPED/5X,4HXBRK,5X,4HYBRK/5X,1P10E10.3)
118 FORMAT (1X,5X,13,2X,13HITERATIONS---)
120 FORMAT (1X,10HDELS IN = ,F8.5,3X,7HDELS = ,F8.5,3X,11HDELS OUT = ,
1F8.5,3X,5HDSTEST = ,F8.5)
ENC

```

3IBF1C AREA.

```

SUBROUTINE AREA
COMMON /SS/ NBDY1,NBDY2,TYPDY,NBYS
COMMON /FCR3SS/ I,DELS,XBK(20),YBK(20),XCN(500),YCN(500),DYDXO(500
1),ALPHA(500),CAPPA(500),SON(500),PIO180
COMMON /NSD/ NSD,NSDBDY(10)
DIMENSION JMAX(20),JMIN(20),YLS(20),YHS(20),AREAS(20),YAR(20)
PI=3.14159265
NEP1=NBDY1+1
DO 2 J=NEP1,NBDY2
JJ=J
IF (YCN(J).LT.XCN(J+1)) GO TO 4
CONTINUE
WRITE (6,26)
IF (NSD.EQ.C) GO TO 14
SEARCH FOR MINIMUM AND MAXIMUM X ON EACH NSD (SPLITTER)

NB=NBDY2+1
NE=NBDY2+NSDBDY(1)
DO 12 I=1,NSD
XMIN=XCN(NB)
JMIN(I)=NB
XMAX=XCN(NE)
JMAX(I)=NE
NEM1=NE-1
DO 10 J=NB,NEM1
IF (XCN(J).GT.XMAX) GO TO 6
IF (XCN(J).LT.XMIN) GO TO 8
GO TO 10
6 XMAX=XCN(J)
JMAX(I)=J
GO TO 10
8 XMIN=XCN(J)
JMIN(I)=J
10 CONTINUE
NB=NE+1
NE=NE+NSDBDY(I+1)
WRITE (6,26) XMIN,XMAX,JMIN(I),JMAX(I)
CONTINUE
12 DO 24 J=NEP1,JJ
IA=1
CALL SINIP (XCN,YCN,NBDY1,XCN(J),YAR(IA))
IF (NSD.EQ.C) GO TO 18
JEND=NBDY2
DO 16 I=1,NSD
JMI=JMIN(I)
JMA=JMAX(I)
JEND=NSDBDY(I)+JEND
IF (XCN(J).GT.XCN(JMA).OR.XCN(J).LT.XCN(JMI)) GO TO 16
IA=IA+1

```

```

      CALL SINIP (XON(JMA),YON(JMA),JMI-JMA+1,XON(J),YAR(IA))
      IA=IA+1
      CALL SINIP (XON(JMI),YON(JMI),JEND-JMI+1,XON(J),YAR(IA))
16     CONTINUE
18     IA=IA+1
      YAR(IA)=YON(J)
      IS=C
      AREA=0.0
      DO 20 I=1,IA,2
      IS=IS+1
      AREAS(IS)=(YAR(I+1)**2-YAR(I)**2)*PI
      AREA=AREA+AREAS(IS)
20     CONTINUE
      AREAD=AREA+YAR(1)**2*PI
      IF (INNSC.EC.Q) GO TO 22
      WRITE (6,30) (AREAS(I),I=1,IS)
22     WRITE (6,32) J,XON(J),YON(J),YAR(1),AREA,AREAD
      WRITE (6,34)
24     CONTINUE
      RETURN
C
26     FORMAT (1H1//9X,1H1,14X,3HXCN,18X,3HYON,19X,4HYONH,17X,4HAREA,14X,
19HDISC AREA)
28     FORMAT (1HC,5X,7HXMIN = ,1PE14.5,5X,7HXMAX = ,1PE14.5,5X,7HJMIN =
1,1E,5X,7HJMAX = ,1E)
30     FORMAT (74X,1PE21.4)
32     FORMAT (8X,13,1P5E21.4)
34     FORMAT (1HC)
      END

```

# SIBFIC NSCRCL

```

C      FIND N FOR THE SUPERCIRCLE  $F(N) = (X/A)**N + (Y/B)**N - 1 = 0$ 
C      FROM X,Y,A,B
C
      SUBROUTINE FONISC (N)
      REAL LOGXCA,LOGYCB
      COMMON /SUPN/ XCA,YCB,LOGXCA,LOGYCB
      REAL NM,NMP1,N
      DATA TOL/.1E-6/
      IF (ABS(XCA-.5)-.5) 2,4,4
2     IF (ABS(YCB-.5)-.5) 6,4,4
4     WRITE (6,14) XCA,YCB
6     NM=1.
8     XCATCN=XCA**NM
      YCBTCN=YCB**NM
      FCFN=XCATCN+YCBTCN-1.
      FPCFN=XCATCN*LOGXCA+YCBTCN*LOGYCB
      NMP1=NM-FCFN/FPCFN
      IF (ABS(NM-NMP1)/NM-TOL) 12,10,10
10    NM=NMP1
      GO TO 8
12    N=NMP1
      RETURN
C
14    FORMAT (1X/1X,41HREQUESTED PCINT IS OUTSIDE MAGIC TRIANGLE)
      END

```

# \*IBFTC SIMQ.

## ..... SUBROUTINE SIMQ

### PURPOSE

OBTAIN SOLUTION OF A SET OF SIMULTANEOUS LINEAR EQUATIONS,  
 $AX=B$

### USAGE

CALL SIMQ(A,B,N,KS) .

### DESCRIPTION OF PARAMETERS

A - MATRIX OF COEFFICIENTS STORED COLUMNWISE. THESE ARE  
DESTROYED IN THE COMPUTATION. THE SIZE OF MATRIX A IS  
N BY N.

B - VECTOR OF ORIGINAL CONSTANTS (LENGTH N). THESE ARE  
REPLACED BY FINAL SOLUTION VALUES, VECTOR X.

N - NUMBER OF EQUATIONS AND VARIABLES. N MUST BE .GT. ONE.

KS - OUTPUT DIGIT

0 FOR A NORMAL SOLUTION

1 FOR A SINGULAR SET OF EQUATIONS

### REMARKS

MATRIX A MUST BE GENERAL.

IF MATRIX IS SINGULAR, SOLUTION VALUES ARE MEANINGLESS.

AN ALTERNATIVE SOLUTION MAY BE OBTAINED BY USING MATRIX  
INVERSION (MINV) AND MATRIX PRODUCT (GMPRD).

### SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED

NONE

### METHOD

METHOD OF SOLUTION IS BY ELIMINATION USING LARGEST PIVOTAL  
DIVISOR. EACH STAGE OF ELIMINATION CONSISTS OF INTERCHANGING  
ROWS WHEN NECESSARY TO AVOID DIVISION BY ZERO OR SMALL  
ELEMENTS.

THE FORWARD SOLUTION TO OBTAIN VARIABLE N IS DONE IN  
N STAGES. THE BACK SOLUTION FOR THE OTHER VARIABLES IS  
CALCULATED BY SUCCESSIVE SUBSTITUTIONS. FINAL SOLUTION  
VALUES ARE DEVELOPED IN VECTOR B, WITH VARIABLE 1 IN B(1),  
VARIABLE 2 IN B(2),....., VARIABLE N IN B(N).

IF NO PIVOT CAN BE FOUND EXCEEDING A TOLERANCE OF 0.0,  
THE MATRIX IS CONSIDERED SINGULAR AND KS IS SET TO 1. THIS  
TOLERANCE CAN BE MODIFIED BY REPLACING THE FIRST STATEMENT.

.....

SUBROUTINE SIMQ (A,B,N,KS)  
DIMENSION A(1), B(1)

FORWARD SOLUTION



```

C      TOL=0.0
      KS=C
      JJ=-N
      DO 16 J=1,N
      JY=J+1
      JJ=JJ+N+1
      BIGA=0
      IT=JJ-J
      DO 4 I=J,N

C      SEARCH FOR MAXIMUM COEFFICIENT IN COLUMN
C
      IJ=IT+I
      IF (ABS(EIGA)-ABS(A(IJ))) 2,4,4
      BIGA=A(IJ)
      IMAX=I
      CCNTINUE

C      TEST FOR PIVOT LESS THAN TOLERANCE (SINGULAR MATRIX)
C
      IF (ABS(EIGA)-TOL) 6,6,8
      KS=1
      RETURN

C      INTERCHANGE ROWS IF NECESSARY
C
      I1=J+N*(J-2)
      IT=IMAX-J
      DO 10 K=J,N
      I1=I1+N
      I2=I1+IT
      SAVE=A(I1)
      A(I1)=A(I2)
      A(I2)=SAVE

C      DIVIDE EQUATION BY LEADING COEFFICIENT
C
      A(I1)=A(I1)/BIGA
      SAVE=B(IMAX)
      B(IMAX)=E(J)
      B(J)=SAVE/BIGA

C      ELIMINATE NEXT VARIABLE
C
      IF (J-N) 12,18,12
      IQS=N*(J-1)
      DO 16 IX=JY,N
      IXJ=IQS+IX
      IT=J-IX
      DO 14 JX=JY,N
      IXJX=N*(JX-1)+IX
      JJX=IXJX+IT
      A(IXJX)=A(IXJX)-(A(IXJ)*A(JJX))
      B(IX)=B(IX)-(B(J)*A(IXJ))

C      BACK SOLUTION
C
      NY=N-1
      IT=N*N
      DO 20 J=1,NY
      IA=IT-J
      IB=N-J
      IC=N
      DO 20 K=1,J
      B(IB)=B(IB)-A(IA)*B(IC)
      IA=IA-N
      IC=IC-1
      RETURN
      END

```

EOD

\$IBFTC EOD

DECK

C\*  
C  
C  
C  
C  
C  
C  
C

\*\* DOUGLAS NEUMANN POTENTIAL FLOW PROGRAM \*\*

\* CALCULATION OF POTENTIAL FLOW ABOUT BODIES OF  
REVOLUTION HAVING FLOWS PARALLEL AND PERPENDICULAR  
TO THE AXIS OF REVOLUTION.

\* MAIN PROGRAM

COMMON / NBSAVE / NBCLD, NIN

NBCLD = 0

COMMON	HEDR(10)	CASE	NB	NNU	
1	,FLG03	,FLG04	,FLG05	,FLG06	,FLG07
2	,FLG08	,FLG09	,FLG10	,FLG11	,FLG12
3	,FLG13	,FLG14	,FLG15	,FLG16	,FLG17
4	,FLG18	,FLG19	,FLG20	,FLG21	,FLG22
5	,FLG23	,FLG24	,FLG25	,FLG26	,FLG27

DOUBLE PRECISION HEDR, CASE  
INTEGER

	FLG03	,FLG04	,FLG05	,FLG06	,FLG07
1	,FLG08	,FLG09	,FLG10	,FLG11	,FLG12
2	,FLG13	,FLG14	,FLG15	,FLG16	,FLG17
3	,FLG18	,FLG19	,FLG20	,FLG21	,FLG22
4	,FLG23	,FLG24	,FLG25	,FLG26	,FLG27

COMMON NT, ND(11), MN, NUNA(4), TYPEA(4)  
1, NER1, NER2, NMA, NSIGA, NSIGC  
2, NUNC(4), TYPEC(4), NLF(11)

COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)  
COMMON /P/ IPUVEL  
REAL MN

C

REWIND 13  
10 REWIND 12  
REWIND 4  
REWIND 3  
REWIND 8  
REWIND 9  
REWIND 10  
REWIND 11  
REWIND 15  
REWIND 16  
CALL PART1

\*\*\* \*\*PRESCRIBED VORTICITY IMPLIES TRIANGULARIZATION METHOD OF MATRIX

\*\*\* \*\*SOLUTION (SOLVIT)

IF (FLG19.GT.0.OR.FLG13.GT.0) GO TO 30  
15 CALL PART2  
GO TO 40  
30 CALL PREP  
40 CALL PART4  
GO TO 10  
END

\$IBFTC PCH1 DECK

SUBROUTINE PUNCHC(R,J,LOC,CASE)  
DIMENSION R(400)  
RETURN  
END

\$IBFTC TIMEX DECK

SUBROUTINE TIMEV(T)  
CALL TIME1(T)  
T=T/3600.  
RETURN  
END

\$IBFTC PCH DECK

SUBROUTINE PUNCHV(AP,J,L,LCC,CASE)  
DIMENSION AP(500,4), T(500)  
RETURN  
END

\$IBFTC PAT1 DECK

SUBROUTINE PART1

C  
C  
C

\* CONTROL FOR BASIC DATA AND FORM MATRIX

```
COMMON / NBSAVE / NECLD, NIN
COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,YPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,YPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /P/ IPUVEL
REAL      MN
```

C

```
COMMON /CL/      X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/      TX1(500), TY1(500), NG(500), TG(500), ALFA(500),
1           RSDS(500), CALF(500), SEQ1, SEQ2, NSEQ,
2           CHORD, TEMP(600), TCNST, DUMMY(4915)
INTEGER      BDN      ,SUBKS      ,SEQ1      ,SEQ2
REAL      MX      ,MY      ,NG
```

C  
C  
C

\* START

\* READ INPUT DATA

```
NSEQ=0
100 READ (5,4) HEDR, CASE, SEQ1, NB, NNU, FLG03, FLG04, FLG05, FLG06,
1           FLG07, FLG08, FLG09, FLG10, FLG11, FLG12, FLG13, FLG14,
2           FLG15, FLG16, FLG17, FLG18, FLG19, FLG20, FLG21, FLG22,
3           FLG23, FLG24, FLG25, FLG26, FLG27, IPUVEL, NIN, SEQ2
C*** **TRIANGULARIZATION OF THE MATRIX (SOLVIT) IS THE DEFAULT SOLUTION
IF(FLG09.EQ.0.AND.FLG10.EQ.0)FLG13=1
C*** ***FLG22 IS GENERATED (RESEP) BOUNDARY CONDITIONS
C*** ***FLG21 IS EXTRA CROSS FLOW
1 IF (FLG22.LE.0)GO TO 5
FLG21 = 1
FLG03 = 1
FLG04 = 1
C*** ***IF FLAG 18 IS NOT EQUAL TO FLAG 14 YOU MUST USE DIRECT MATRIX
5 IF (FLG18.NE.FLG14)GO TO 2
IF (FLG21.LE.0)GO TO 3
FLG12 = 1
2 FLG13 = 1
FLG09 = 0
FLG10 = 0
```

```

3 CONTINUE
  IF( NBOLD .EQ. 0 )      NBOLD = NB
C*** **CARDS (UNIT 5) ARE THE DEFAULT METHOD OF INPUT
  IF( NIN .EQ. 0 )      NIN = 5
  4 FORMAT ( 10A6, 2X A6, 8X I4/ 28I1, I2, 46X, I4 )
  IF (SEQ2.GE.SEQ1) GO TO 120
110 WRITE (6,6)
  6 FORMAT ( 1H0/38H DATA OUT OF SEQUENCE * SORT ON 77-80 )
  STOP
120 SEQ1=SEQ2
  READ (5,8) CHORD, MN, TCNST, SEQ2
  8 FORMAT ( 3F10.0, 46X I4 )
C*** **THE DEFAULT CHORD LENGTH IS 1.0
  IF(CHORD.GT.-1.0E-5.AND.CHORD.LT.1.0E-5)CHORD=1.0
  IF (SEQ2.LT.SEQ1) GO TO 110
  SEQ1=SEQ2
  WRITE (6,12) HEDR, CASE, NB, NNU, CHORD, MN, TCNST
12 FORMAT ( 1H1 25X, 26HCOUGLAS AIRCRAFT COMPANY /
1      28X, 21HLONG BEACH DIVISION ///
2      6X, 43HPROGRAM EODA -- AXISYMMETRIC AND CROSSFLOW //
3      11X, 29H***** CASE CONTROL DATA ***** ///
4      6X, 10A6, 4X, 10HCASE NO. A6 //
5      6X 9HBODIES =I3/ 6X 9HNUU      =I3/ 6X 9HCHORD      =F12.7/
6      6X 9HMACH NO.=F12.8/ 6X 9HTCNST  =F12.7/// )
  IF (FLG03.GT.0) WRITE (6,16)
16 FORMAT (13X 21HSURFACE OF REVOLUTION )
  IF (FLG04.GT.0) WRITE (6,20)
20 FORMAT (13X 9HCROSSFLOW)
  IF (FLG05.GT.0) WRITE (6,24)
24 FORMAT (13X 15HOFF-BODY POINTS )
  IF (FLG06.GT.0) WRITE (6,28)
28 FORMAT (13X 15HBASIC DATA ONLY )
  IF (FLG07.GT.0) WRITE (6,32)
32 FORMAT (13X 17HELLIPSE GENERATOR )
  IF (FLG08.GT.0) WRITE (6,36)
36 FORMAT (13X 14HPRINT MATRICES )
  IF (FLG09.GT.0) WRITE (6,40)
40 FORMAT (13X 10HOLD SEIDEL )
  IF (FLG10.GT.0) WRITE (6,44)
44 FORMAT(13X,31HMODIFIED SEIDEL MATRIX SOLUTION)
  IF (FLG11.GT.0) WRITE (6,48)
48 FORMAT (13X 18HPERTURBATIONS ONLY )
  IF (FLG12.GT.0) WRITE (6,52)
52 FORMAT (13X 22HSOLVE POTENTIAL MATRIX )
  IF (FLG13.GT.0) WRITE (6,56)
56 FORMAT (13X 47HMATRIX SOLUTION BY TRIANGULARIZATION (SOLVIT))
  IF (FLG14.GT.0) WRITE (6,53)
53 FORMAT ( 13X 30HPRESCRIBED TANGENTIAL VELOCITY )
  IF (FLG18.GT.0) WRITE (6,69)
69 FORMAT ( 15X 22HWITH SURFACE VORTICITY )
  IF (FLG15.GT.0) WRITE (6,54)
54 FORMAT (13X 12HSTRIP VORTEX )
  IF (FLG16.GT.0) WRITE (6,64)
64 FORMAT (13X 40HOMIT AXI-SYMMETRIC UNIFORM FLOW SOLUTION )
  IF (FLG17.GT.0) WRITE (6,68)
68 FORMAT (13X 36HOMIT CROSSFLOW UNIFORM FLOW SOLUTION )

```

```

      IF (FLG19.GT.0) WRITE (6,72)
72  FORMAT (13X 20HPRESCRIBED VORTICITY)
      IF (FLG20.GT.0) WRITE (6,78)
78  FORMAT (13X 15HTOTAL VORTICITY )
      IF (FLG21.GT.0)WRITE(6,77)
77  FORMAT (13X 16HEXTRA CROSS FLOW)
      IF(FLG22.GT.0) WRITE(6,81)
81  FORMAT(13X 82HGENERATED BOUNDARY CONDITIONS FOR 3 AXISYMMETRIC, 1
      1CROSS, AND 1 EXTRA CROSS FLOW.)
      IF (FLG19.GT.0) FLG18=1
      IF (FLG22.GT.0.AND.NB.NE.2) GO TO 82
      GO TO 84
82  WRITE(6,83)
83  FORMAT (128H0 WHEN GENERATED RESEP BOUNDARY CONDITIONS ARE USED,NU
      1MBER OF BODIES MUST BE EXACTLY TWO. YOU GOOFED. EXECUTION TERM
      2INATING.)
      STOP
84  IF (FLG22.GT.0.AND.NNU.GT.0)GO TO 86
      GO TO 88
86  WRITE (6,87)
87  FORMAT (98H0 GENERATED RESEP BOUNDARY CONDITIONS CANNOT HAVE NON-U
      1NIFORM FLOW INPUT. EXECUTION TERMINATING.)
88  IF (IPUVEL.NE.0)WRITE (6,73)
73  FORMAT (13X 14HPUNCHED OUTPUT)
      WRITE ( 6,75 ) NIN
      IF (FLG18.LE.0.OR.FLG14.GT.0) GO TO 125
75  FORMAT( 13X,58HINPUT TAPE NO. FOR COORDINATES AND NON-UNIFORM FLO
      1W ONLY = , I5 )
      WRITE (6,70)
70  FORMAT (11H0//63H FLG14 MUST BE USED WITH FLG18 OR FLG19. EXECUTIO
      1N TERMINATED. )
      STOP
125 IF (NNU.LE.0.OR.FLG14.LE.0) GO TO 130
      WRITE (6,60)
60  FORMAT (11H0// 49H COLUMNS 2 AND 14 OF FLAG CARD ARE BOTH NON-ZERO.
      A / 43H ILLEGAL COMBINATION. EXECUTION TERMINATED. )
      STOP
C      * READ DATA AND SETUP FOR UNIFORM FLOW
130 CALL BASIC1
C*** **NSIGA AND NSIGC ULTIMATELY BECOME THE NUMBER OR RIGHT HAND SIDES
C*** **IN AXISYMMETRIC FLOW AND CROSS FLOW RESPECTIVELY
133 NSIGA=0
      IF (FLG03.GT.0.AND.FLG16.LE.0) NSIGA=1
      NSIGC=0
      IF (FLG04.GT.0.AND.FLG17.LE.0) NSIGC=1
      IF (FLG22.GT.0) GO TO 136
      DO 135 I = 1, 4
      NUNA(I) = 123456
135 TYPEA(I) = 100.
      GO TO 138
C*** **PREPARE NUNA AND TYPEA FOR NON-UNIFORM AXISYMMETRIC FLOW,GENER
C*** **((RESEP) BOUNDARY CONDITIONS
136 DO 137 I = 1,3
      NUNA(I) = I
137 TYPEA(I) = 100.0
138 CONTINUE

```

```

C*** ***IF FLG02 (NON-UNIFORM FLOW) IS NOT CHECKED INITIALLY, THE FLOW
C*** ***OF CONTROL WILL NEVER REACH BASIC2
      IF (NNU) 140,150,140
C      O * READ DATA AND SETUP FOR NON-UNIFORM FLOW
140 CALL BASIC2
150 IF (NSEQ) 160,160,110
160 REWIND 4
      IF (NSIGA.LE.4) GO TO 180
170 WRITE (6,74)
      74 FORMAT (1H1 75HAXI-SYMMETRIC OR CROSSFLOW NON-UNIFORM FLOWS EXCEED
      A 4. EXECUTION TERMINATED )
      STOP
180 IF (NSIGC.GT.4) GO TO 170
      IF (FLG15.LE.0.OR.FLG03.GT.0) GO TO 200
      WRITE (6,190)
190 FORMAT (64H1STRIP RING VORTEX OPTION MUST USE SURFACE OF REVOLUTIO
      IN OPTION. / 22H EXECUTION TERMINATED. )
      STOP
200 IF (FLG15.LE.0) GO TO 230
      J = 0
      DO 210 I = 1, NB
210 IF (NLF(I).LE.0) J=J+1
      IF (NSIGA+J.LE.4) GO TO 230
      WRITE (6,220)
220 FORMAT (68H1GENERATED STRIP VORTEX ONSET FLOWS (ONE FOR EACH LIFTI
      ING BODY) PLUS / 34H INPUT NON-UNIFORM FLOWS EXCEED 4. /
      2 22HOEXECUTION TERMINATED. )
      STOP
230 IF (FLG06.NE.0) GO TO 100
      CALL MATRIX
      RETURN
      END

```

\$IBFTC BASI DECK,DEBUG

C

SUBROUTINE BASIC1

C

C

C

\* READ DATA AND SETUP FOR UNIFORM FLOW

```
COMMON / NBSAVE / NBCLD, NIN
COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
DIMENSION COSSQR(500), RHS(500)
REAL      MN
```

C

```
COMMON /CL/      X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/      TX1(500), TY1(500), NG(500), TG(500), ALFA(500),
1           RSDS(500), CALF(500), SEQ1, SEQ2, NSEQ,
2           CHORD, TEMP(600), TCNST, DUMMY(4915)
INTEGER      BDN      ,SUBKS      ,SEQ1      ,SEQ2
REAL      MX      ,MY      ,NG
```

C

C

\* START

NT=0

K=0

K2=NB

IF( NIN .EQ. 0 ) NIN = 5

IF (FLG05.NE.0) K2=NB+1

C

\* MAJOR LOOP \* NO. OF BODIES + OFF BODY POINTS

DO 1000 U=1,K2

READ (5,15) NN, MX, MY, THETA, ADDX, ADDY, SEQ2

15 FORMAT ( 5X I5, 5F10.0, 16X I4)

IF (SEQ2.LT.SEQ1) NSEQ=1

SEQ1=SEQ2

READ (5,16) BDN, SUBKS, NLF(L), XE, YE, SEQ2

16 FORMAT (3(5X, I5), 2F10.0, 26X I4)

IF (SEQ2.LT.SEQ1) NSEQ=1

SEQ1=SEQ2

C\*\*\* \*\*ND(L) IS THE NUMBER OF POINTS ON BODY L, OR THE NUMBER OF OFF



```

C*** ***BODY PCINTS FOR L = NB + 1
      ND(L)=NN
      M=NN-1
      IF (SUBKS) 140,150,140
140   IF( L .NE. K2 )      GO TO 148
      NTIMES = NBOLD - NB
      IF( NTIMES .LE. 0 )      GO TO 148
      DO 145 NSKIPS = 1, NTIMES
145   READ(13) ( TX1(I),I=1,NN), (TY1(I),I=1,NN )
148   READ(13) ( TX1(I),I=1,NN), (TY1(I),I=1,NN )
      GO TO 220
150   IF (BDN.EQ.0) GO TO 200
      IF (FLG07) 160,200,160
C      * ELLIPSE GENERATOR FOR X1 AND Y1
160   IF (XE.EQ.0.0) XE=1.
      IF (YE.EQ.0.0) YE=1.
      EN=M
      DGAM=3.141593 /EN
      GAM=3.141593
      DO 170 I=1,NN
      TX1(I)=XE*COS(GAM)
      TY1(I)=YE*SIN(GAM)
170   GAM=GAM-DGAM
      GO TO 210
C      * READ X1 AND Y1 FROM INPUT CARDS
200   DO 204 I=1,NN,6
      READ(NIN,20)TX1(I),TX1(I+1),TX1(I+2),TX1(I+3),TX1(I+4),TX1(I+5),
1      SEQ2
20   FORMAT ( 6F10.0, 16X I4)
      IF (SEQ2.LT.SEQ1) NSEQ=1
204   SEQ1=SEQ2
      DO 206 I=1,NN,6
      READ(NIN,20)TY1(I),TY1(I+1),TY1(I+2),TY1(I+3),TY1(I+4),TY1(I+5),
1      SEQ2
      IF (SEQ2.LT.SEQ1) NSEQ=1
206   SEQ1=SEQ2
C      * SAVE X1 AND Y1 FOR SUBCASE
210   WRITE (13) (TX1(I),I=1,NN),(TY1(I),I=1,NN)
C      * BASIC DATA CALC. AND PRINT (UNTRANSFORMED COORDINATES)
220   WRITE (6,24) HEDR, NN, MX, MY, THETA, ADDX, ADDY, XE, YE
24   FORMAT ( 1H1 25X 26HDCUGLAS AIRCRAFT COMPANY /
1      28X 21HLCNG BEACH DIVISION /// 5X 10A6 //
2      8X 4HNN = I4, 15X 4HMX = F13.7, 4X 4HMY = F13.7 /
3      5X 7HTHETA = F13.7, 4X 6HADDX = F13.7, 2X 6HADDY = F13.7/
4      8X 4HXE = F13.7, 6X 4HYE = F13.7 )
      IF (BDN) 240,230,240
230   WRITE (6,28) (I, TX1(I), TY1(I), I=1,NN)
28   FORMAT ( 1H0 4X 36HOFF-BODY COORDINATES (UNTRANSFORMED) //
1      10X 5HX-OFF 9X 5HY-OFF // (1H I3, 2F14.7))
      GO TO 270
240   SUMS=0.0
      DO 250 I=1,M
      T1=TX1(I+1)-TX1(I)
      T2=TY1(I+1)-TY1(I)
      X2(I)=(TX1(I+1)+TX1(I))/2.
      Y2(I)=(TY1(I+1)+TY1(I))/2.

```

```

DELS(I)=SQRT(T1*T1+T2*T2)
SUMS=SUMS+DELS(I)
RSDS(I)=SUMS
250 ALFA(I) = ATAN2( T2, T1 )
MA=M-1
DO 260 I=1,MA
260 DALF(I) = ( ALFA(I+1)-ALFA(I) ) * 57.29578
WRITE (6,36) BDN,TX1(I),TY1(I),X2(I),Y2(I),DELS(I),RSDS(I)
36 FORMAT ( 1H0 4X 35HON-BODY COORDINATES (UNTRANSFORMED) /
1 9H BODY NO. I3// 11X 2H X 13X 1HY 11X 7HDELTA S 7X
2 5HSUMDS 8X 7HD ALPHA // 1H 3H 1,2F14.7 / 4X 4F14.7)
WRITE (6,40) (I, TX1(I), TY1(I), DALF(I-1), X2(I), Y2(I),
1 DELS(I), RSDS(I), I=2,M) , NN, TX1(NN), TY1(NN)
40 FORMAT ( 1H I3, 2F14.7, 28X F14.7 / 4X 4F14.7)
C * ADJUST COORDINATES (TRANSFORMED)
270 IF (MX) 280,300,280
280 DO 290 I=1,NN
290 TX1(I)=TX1(I)*MX
300 IF (MY) 310,330,310
310 DO 320 I=1,NN
320 TY1(I)=TY1(I)*MY
330 IF (THETA) 340,360,340
340 THETA = THETA / 57.29578
CSTHT = COS(THETA)
SNTHT = SIN(THETA)
DO 350 I=1,NN
T1=TX1(I)
TX1(I)=T1*CSTHT+TY1(I)*SNTHT
350 TY1(I)=TY1(I)*CSTHT-T1*SNTHT
360 IF (ADDX) 370,390,370
370 DO 380 I=1,NN
380 TX1(I)=TX1(I)+ADDX
390 IF (ADDY) 400,420,400
400 DO 410 I=1,NN
410 TY1(I)=TY1(I)+ADDY
420 IF (CHORD .EQ. 1.0 .OR. CHORD .EQ. 0.0 )GO TO 450
430 DO 440 I=1,NN
TX1(I)=TX1(I)/CHORD
440 TY1(I)=TY1(I)/CHORD
450 IF (MN) 460,475,460
460 SRM=SQRT(1.-MN*MN)
DO 470 I=1,NN
470 TX1(I)=TX1(I)/SRM
C * SHIFT X1 AND Y1 TO COMMON /CL/
C*** **IF BDN = 0.0, OFF BODY POINTS ARE BEING OPERATED ON
475 IF (BDN) 500,480,500
480 DO 490 I=1,NN
XP(I)=TX1(I)
490 YP(I)=TY1(I)
WRITE (12) (XP(I),I=1,NN),(YP(I),I=1,NN)
GO TO 1000
500 DO 510 I=1,NN
K=K+1
X1(K)=TX1(I)
510 Y1(K)=TY1(I)
NT=NT+M

```

```

1000 CONTINUE
      REWIND 13
      IF (FLG14.LE.0) GO TO 2000
      IF (FLG14.LE.NB) GO TO 1050
      WRITE (6,1025)
1025  FORMAT (45H1VALUE OF FLG14 EXCEEDS NO. OF BODIES.  STOP. )
      STOP
1050  IF (FLG14.NE.NB) GO TO 1075
      NMA=0
      GO TO 1150
1075  L = NB-FLG14
      NMA = -L
      DO 1100 I = 1, L
C*** ***NMA BECOMES THE NUMBER OF ELEMENTS ON THE 1ST L BODIES (IE THOSE
C*** ***NOT HAVING AN INPUT VORTICITY OR VELOCITY)
      1100 NMA = NMA + ND(I)
C*** ***NR BECOMES THE NUMBER OF ELEMENTS RECEIVING AN INPUT VORTICITY
C*** ***OR VELOCITY
      1150 NR = NT-NMA
      IF (TCNST.GT.0.)GO TO 2000
      DO 1200 I = 1,NR,6
      READ (5,20) TG(I),TG(I+1),TG(I+2),TG(I+3),TG(I+4),TG(I+5),SEQ2
      IF (SEQ2.LT.SEQ1) NSEC=1
1200  SEQ1=SEQ2
C      * CALC. PARAMETERS WITH TRANSFORMED COORDINATES AND
C      MACH NO. ADJUSTMENT
2000  N1=0
      J1=0
      DO 2500 K=1,NB
      M1=N1+1
      N1=N1+ND(K)-1
      DO 2400 J=M1,N1
      J1=J1+1
      T1=X1(J1+1)-X1(J1)
      T2=Y1(J1+1)-Y1(J1)
      X2(J)=(X1(J1+1)+X1(J1))/2.
      Y2(J)=(Y1(J1+1)+Y1(J1))/2.
      DELS(J)=SQRT(T1*T1+T2*T2)
      COSA(J)=T1/DELS(J)
2400  SINA(J)=T2/DELS(J)
2500  J1=J1+1
C      * SAVE PARAMETERS
      WRITE (12) (X1(I),I=1,J1),(Y1(I),I=1,J1),(X2(I),I=1,NT)
1      , (Y2(I),I=1,NT),(DELS(I),I=1,NT)
      REWIND 12
C      * SAVE SINA AND COSA ON TAPE 4 FOR CALC. OF MATRIX
C      SOLUTION (RIGHT HAND MATRIX)
      WRITE (4) (SINA(I),I=1,NT),(COSA(I),I=1,NT)
      IF ( FLG14) 2600,2600,2550
2550  IF (TCNST.GT.0.0) WRITE(4) (TCNST,I=1,NR)
      IF (TCNST.LE.0.) WRITE(4) (TG(I), I=1,NR)
2600  IF (FLG22.LE.0) RETURN
      NPB1 = ND(1) - 1
      DO 2700 I = 1,NPB1
      COSSQR(I) = COSA(I)**2
2700  RHS(I) = 2.0 * ABS( SINA(I) * COSA(I) )
      WRITE(4) ( COSSQR(I),I=1,NPB1), (RHS(I),I = 1,NPB1)
      RETURN
      END

```

\$IBFTC BAS2 DECK

C

SUBROUTINE BASIC2

C

C

C

\* READ DATA AND SETUP FOR NON-UNIFORM FLOWS

```
COMMON / NBSAVE / NBCLD, NIN
COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
```

C

```
COMMON /CL/      X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/      TX1(500), TY1(500), NG(500), TG(500), ALFA(500),
1           RSDS(500), CALF(500), SEQ1, SEQ2, NSEQ,
2           CHORD, TEMP(600), TCNST, DUMMY(4915)
INTEGER      BDN      ,SEQ1      ,SEQ2
REAL      MX      ,MY      ,NG
```

C

C

C

\* START

\* SETS OF NON-UNIFORM FLOW LOOP

```
NSIGEC = 0
KA=0
KC=0
KEC = 0
IF( NIN .EQ. 0 )      NIN = 5
DO 1000 L=1,NNU
READ (5,20) NUN,MSF,TYPE,FG,SEQ2
20 FORMAT ( 2(5X I5), 2F10.0, 36X I4 )
IF (SEQ2.LT.SEQ1) NSEQ=1
SEQ1=SEQ2
IF (MSF.EQ.1.OR.MSF.EQ.2.OR.MSF.EQ.5) GO TO 30
KA=KA+1
NSIGA=NSIGA+1
NUNA(KA)=NUN
TYPEA(KA)=TYPE
30 IF (MSF.EQ.0.OR.MSF.EQ.2.OR.MSF.EQ.4) GO TO 35
```

```

      KC=KC+1
      NSIGC=NSIGC+1
      NUNC(KC)=NUN
      TYPEC(KC)=TYPE
35  IF (MSF.LT.2.OR.MSF.EQ.3) GO TO 40
      KEC = KEC + 1
      NSIGEC = NSIGEC + 1
      NUNEC(KEC) = NUN
      TYPEEC(KEC) = TYPE
40  IF (TYPE) 50,70,70
C    * COMPUTED TYPE
50  DO 60 I=1,NT
      NG(I)=Y2(I)
60  TG(I)=FG-X2(I)
      GO TO 110
C    * (X,Y) OR (N,T) TYPE * READ INPUT
70  DO 90 I=1,NT,6
      READ(NIN,80)NG(I),NG(I+1),NG(I+2),NG(I+3),NG(I+4),NG(I+5),SEQ2
80  FORMAT ( 6F10.0, 16X I4)
      IF (SEQ2.LT.SEQ1) NSEC=1
90  SEQ1=SEQ2
      DO 100 I=1,NT,6
      READ(NIN,80)TG(I),TG(I+1),TG(I+2),TG(I+3),TG(I+4),TG(I+5),SEQ2
      IF (SEQ2.LT.SEQ1) NSEC=1
100  SEQ1=SEQ2
110  IF (TYPE) 120,140,120
120  DO 130 I = 1, NT
      T1=NG(I)
      NG(I)= T1*SINA(I)-TG(I)*COSA(I)
      TG(I)= T1*COSA(I)+TG(I)*SINA(I)
C    * WRITE BASIC DATA OUTPUT
140  WRITE (6,150) HEDR,MSF,TYPE,FG,NUN,(NG(I),I=1,NT)
150  FORMAT ( 1H1 25X 26HDCUGLAS AIRCRAFT COMPANY /
1      28X, 21HLONG BEACH DIVISION /// 5X 10A6 //
2      6X 5HMSF = I4, 10X 6HTYPE = F10.4, 10X 4HFG = F13.7 /
3      1H0, 4X, 20HNON-UNIFORM FLOW NO.I6 /
4      1H0, 4X, 10HLIST OF NG// (1H 6F14.7))
      WRITE (6,160) (TG(I), I = 1, NT)
160  FORMAT (1H0 4X 10HLIST OF TG // (1H 6F14.7))
      WRITE (4) MSF,(NG(I),I=1,NT),(TG(I),I=1,NT)
1000 CONTINUE
      RETURN
      END

```

\$IBFTC MATRX DECK,DEBUG

C

SUBROUTINE MATRIX

C

C

C

\* COMPUTE MATRIX A,B,Z OR X,Y,Z

```
COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,NC(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
LOGICAL PF
```

C

```
COMMON /ECF/ ECX(500), ECY(500), ECZ(500)
COMMON /CL/  X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/  A(500), B(500), AX(500), AY(500), AZ(500),
1           CX(500), CY(500), CZ(500), AXV(500), AYV(500),
2           VN(500,4), VT(500,4), BON, YZERO, IAC,
3           I, J, J1, SJ, DS,
4           DX, DY, NI, XJ, YJ,
5           XK, EEK, EKK, K, PF
```

C

C

C

\* START

\* INITIALIZE

L1=NT

BGN=0.0

YZERO=0.0

```
C***      ***TEST TYPE OF FLOW AND SET INDICATORS IAC AND IEC
C***      ***CROSS FLOW ONLY      IAC = -1 IEC = -1
C***      ***AXISYMMETRIC FLOW ONLY      IAC = +1 IEC = -1
C***      ***EXTRA CROSS FLOW ONLY      IAC = 0 IEC = 0
C***      ***CROSS FLOW AND AXISYMMETRIC FLOW IAC = 0 IEC = -1
C***      ***CROSS FLOW AND EXTRA CROSS FLOWW IAC = -1 IEC = +1
C***      ***AXISYMMETRIC AND EXTRA CROSS FLOW IAC = +1 IEC = +1
C***      ***AXISYMMETRIC, CROSS, AND EXTRA CROSS IAC=0 IEC = +1
```

IF (FLG03) 30, 10, 30

10 IF (FLG04) 25, 15, 25

15 IAC = 0

```

      IEC = 0
      GO TO 55
25  IAC = -1
      GO TO 45
30  IF (FLG04) 35,40,35
35  IAC = 0
      GO TO 45
40  IAC = 1
45  IF (FLG21) 50,53,50
50  IEC = +1
      GO TO 55
53  IEC = -1
55  ASSIGN 110 TO K1
      IF (FLG15.GT.0) ASSIGN 102 TO K1
60  DO 65 I = 1, L1
      DO 65 J = 1, NB
      VN(I,J) = 0.
65  VT(I,J) = 0.
C      * I MIDPOINT LOOP
      DO 400 I = 1, L1
C      * J ELEMENT LOOP
C      J1 IS THE COORDINATE COUNTER
C      J IS THE ELEMENT COUNTER
      J1 = 0
      N1 = 0
      DO 110 K = 1, NB
      M1 = N1 + 1
      N1 = N1 + ND(K) - 1
      DO 100 J = M1, N1
      J1 = J1 + 1
      PF = FLG18.GT.0.AND.J.GT.NMA.OR.FLG20.GT.0
C      * COMPUTE X,Y,Z MATRICES
      CALL XYZ
100  CONTINUE
      GO TO K1, (102,110)
102  IF (NLF(K).GT.0) GO TO 110
      IF (BON.EQ.0.) GO TO 105
      DO 103 J = M1, N1
      VN(I,K) = VN(I,K) + AXV(J)
103  VT(I,K) = VT(I,K) + AYV(J)
      GO TO 110
105  DO 106 J = M1, N1
      VN(I,K) = VN(I,K) + AXV(J)*SINA(I) - AYV(J)*COSA(I)
106  VT(I,K) = VT(I,K) + AXV(J)*COSA(I) + AYV(J)*SINA(I)
110  J1 = J1 + 1
      IF (BON) 120,210,120
C      * SAVE X,Y,Z ON TAPE *OFF BODY POINTS
C***  ***SAVE X,Y,Z ON TAPE * OFF BODY POINTS
C***  ***AXISYMMETRIC FLOW * TAPE 9
C***  ***CROSS FLOW * TAPE 10
C***  ***EXTRA CROSS FLOW * TAPE 8
120  IF (IEC.EQ.-1) GO TO 125
122  WRITE(8) (ECX(J),J=1,NT), (ECY(J),J=1,NT), (ECZ(J),J=1,NT)
      IF (IEC) 125,400,125
125  IF (IAC) 140,130,130
130  WRITE (9) (AX(J),J=1,NT),(AY(J),J=1,NT),(AZ(J),J=1,NT)

```

```

      IF (IAC) 400,140,400
140  WRITE (10) (CX(J),J=1,NT), (CY(J),J=1,NT), (CZ(J),J=1,NT)
      GO TO 400
C***   ***SAVE ON TAPE   *   ON BODY
C***   ***AXISYMMETRIC FLOW   *   TAPE 9
C***   ***CROSS FLOW   *   TAPE 10
C***   ***EXTRA CROSS FLOW   *   TAPE 8
C***   ***IEC = -1 MEANS NO EXTRA CROSS FLOW
210  IF (IEC.EQ.-1) GO TO 240
220  DO 230 J = 1,NT
      A(J) = -ECX(J) * SINA(I) + ECY(J) * COSA(I)
230  B(J) = ECX(J) * COSA(I) + ECY(J) * SINA(I)
      WRITE (8) (A(J),J=1,NT), (B(J),J=1,NT), (ECZ(J),J=1,NT)
      IF ( IEC ) 240,400,240
240  IF (IAC) 310,250,250
250  DO 260 J=1,NT
      A(J)=-AX(J)*SINA(I)+AY(J)*COSA(I)
260  B(J)=AX(J)*COSA(I)+AY(J)*SINA(I)
      WRITE (9) (A(J),J=1,NT), (B(J),J=1,NT), (AZ(J),J=1,NT)
270  IF (IAC) 400,310,400
310  DO 320 J=1,NT
      A(J)=-CX(J)*SINA(I)+CY(J)*COSA(I)
320  B(J)=CX(J)*COSA(I)+CY(J)*SINA(I)
      WRITE (10) (A(J),J=1,NT), (B(J),J=1,NT), (CZ(J),J=1,NT)
400  CONTINUE
      IF (FLG15.LE.0) GO TO 1400
      IF (BON.NE.0.) GO TO 1200
C***   ***ON BODY
      READ (4)
      IF (NNU.LE.0) GO TO 600
      DO 500 I = 1, NNU
      READ (4) MSF, (A(J),J=1,NT), (B(J),J=1,NT)
500  WRITE (3) MSF, (A(J),J=1,NT), (B(J),J=1,NT)
      REWIND 3
      REWIND 4
      READ (4)
600  N=NSIGA-1
      IF (FLG16.GT.1) N=NSIGA
C***   ***N = 0 MEANS 1 RHS ONLY   NO NON-UNIFORM FLOW
      IF (N.EQ.0) GO TO 800
      DO 700 I = 1, N
      READ (3) MSF, (A(J),J=1,NT), (B(J),J=1,NT)
700  WRITE(4) MSF, (A(J),J=1,NT), (B(J),J=1,NT)
800  M=0
      DO 900 J = 1, NB
      IF (NLF(J).GT.0) GO TO 900
      NSIGA=NSIGA+1
      NNU=NNU+1
      WRITE (4) M, (VN(I,J),I=1,NT), (VT(I,J),I=1,NT)
900  CONTINUE
      M=NSIGC-1
      IF (FLG17.GT.0) M=NSIGC
      IF (M.LE.0) GO TO 1100
      DO 1000 I = 1, M
      READ (3) MSF, (A(J),J=1,NT), (B(J),J=1,NT)
1000 WRITE (4) MSF, (A(J),J=1,NT), (B(J),J=1,NT)

```



```

1100 REWIND 3
      GO TO 1400
C*** ***OFF BODY
1200 DO 1300 J = 1, NB
      IF (NLF(J).GT.0) GO TO 1300
      WRITE(4) (VN(I,J), I = 1,L1), (VT(I,J),I = 1,L1)
1300 CONTINUE
C          * TEST IF OFF BODY COMPLETED
C          * TEST IF OFF BODY
1400 IF (FLG05.EQ.0.OR.BON.NE.0.) GO TO 1600
C          * INITIAL FOR OFF BODY * THEN RE-ENTER I,J LOOPS
      BON=1.
      L1=ND(NB+1)
      DO 1500 I = 1, L1
        X2(I) = XP(I)
1500 Y2(I) = YP(I)
      GO TO 60
1600 REWIND 9
      REWIND 8
      REWIND 10
      REWIND 4
      RETURN
      END

```

\$IBFTC XYZ      CECK,DEBUG

C

SUBROUTINE XYZ

C

C

C

\* CONTROL FOR X,Y,Z MATRICES COMPUTATION

```
COMMON    HEDR(10) ,CASE            ,NB            ,NNU
1           ,FLG03       ,FLG04       ,FLG05       ,FLG06       ,FLG07
2           ,FLG08       ,FLG09       ,FLG10       ,FLG11       ,FLG12
3           ,FLG13       ,FLG14       ,FLG15       ,FLG16       ,FLG17
4           ,FLG18       ,FLG19       ,FLG20       ,FLG21       ,FLG22
5           ,FLG23       ,FLG24       ,FLG25       ,FLG26       ,FLG27

DOUBLE PRECISION HEDR, CASE
INTEGER    FLG03       ,FLG04       ,FLG05       ,FLG06       ,FLG07
1           ,FLG08       ,FLG09       ,FLG10       ,FLG11       ,FLG12
2           ,FLG13       ,FLG14       ,FLG15       ,FLG16       ,FLG17
3           ,FLG18       ,FLG19       ,FLG20       ,FLG21       ,FLG22
4           ,FLG23       ,FLG24       ,FLG25       ,FLG26       ,FLG27
COMMON    NT           ,ND(11)       ,MN           ,NUNA(4)       ,TYPEA(4)
1           ,NER1       ,NER2       ,NMA           ,NSIGA       ,NSIGC
2           ,NUNC(4)     ,TYPEC(4)    ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
LOGICAL PF
```

C

0

```
COMMON /CL/    X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1              SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/    A(500), B(500), AX(500), AY(500), AZ(500),
1              CX(500), CY(500), CZ(500), AXV(500), AYV(500),
2              VN(500,4), VT(500,4), BON,    YZERO,    IAC,
3              I,        J,        J1,        SJ,        DS,
4              DX,        CY,        NI,        XJ,        YJ,
5              XK,        EEK,        EKK,        K,        PF
```

C

C

\* START

```
IF (BON) 100,10,100
10 IF (J-I) 110,20,110
C           * J EQUAL I PATH
20 T1=.5*DELS(J)
   SJ=T1/Y2(J)
   IF (SJ-.08) 30,30,40
30 CALL XYZ1
   GO TO 1000
40 SJ=.08
   CALL XYZ1
   NI=33
   T2=.08*Y2(J)
   CS=(T1-T2)/32.
   DX=DS*COSA(J)
   DY=DS*SINA(J)
   XJ=X2(J)+T2*COSA(J)-DX
```

```

      YJ=Y2(J)+T2*SINA(J)-DY
      CALL XYZ2
      GO TO 300
C      * INITIAL Y CCORDINATE MID-POINT FOR ZERO TEST
100 YZERO=Y2(I)-.000001
C      * J NOT EQUAL I PATH
C      * COMPUTE MINIMUM DISTANCE TO I MIDPOINT
110 D1=(X2(I)-X1(J1))**2+(Y2(I)-Y1(J1))**2
      D2=(X2(I)-X2(J))**2+(Y2(I)-Y2(J))**2
      D3=(X2(I)-X1(J1+1))**2+(Y2(I)-Y1(J1+1))**2
      IF (D1-D2) 130,130,120
120 IF (D2-D3) 150,150,140
130 IF (D1-D3) 160,160,140
140 DM=SQRT(D3)
      GO TO 170
150 DM=SQRT(D2)
      GO TO 170
160 CM=SQRT(D1)
C      * COMPUTE NO. OF INTERVALS(NI) AND DELTA S (DS)
C      FOR SIMPSON RULE INTEGRATION
170 IF (DM.EQ.0.0) GO TO 200
      NI=8.*DELS(J)/DM+0.9
      IF (NI) 180,180,190
180 NI=3
      DS=DELS(J)/2.
      GO TO 220
190 NI=NI+NI
      IF (NI-128) 210,200,200
200 NI=128
      DS=DELS(J)/128.
      GO TO 220
210 XNI=NI
      DS=DELS(J)/XNI
      NI=NI+1
220 DX=DS*COSA(J)
      DY=DS*SINA(J)
300 XJ=X1(J1)-DX
      YJ=Y1(J1)-DY
      CALL XYZ2
1000 RETURN
      END

```

\$IBFTC XYZ1 DECK,DEBUG

C

SUBROUTINE XYZ1

C

C

C

\* COMPUTE X,Y,Z MATRICES FOR SJ LESS THAN OR EQUAL .08

```
COMMON HEDR(10) ,CASE ,NB ,NNU
1 ,FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
2 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
3 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
4 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
5 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
1 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
2 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
3 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
4 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
COMMON NT ,ND(11) ,MN ,NUNA(4) ,TYPEA(4)
1 ,NER1 ,NER2 ,NMA ,NSIGA ,NSIGC
2 ,NUNC(4) ,TYPEC(4) ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /ECF/ ECX(500), ECY(500), ECZ(500)
REAL MN
LOGICAL PF
```

C

```
COMMON /CL/ X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1 SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/ A(500), B(500), AX(500), AY(500), AZ(500),
1 CX(500), CY(500), CZ(500), AXV(500), AYV(500),
2 VN(500,4), VT(500,4), BON, IAC,
3 I, J, J1, SJ, DS,
4 DX, CY, NI, XJ, YJ,
5 XK, EEK, EKK, K, PF
```

C

C

C

\* START

\* INITIALIZE

```
T1=SJ*SJ
T2=ALOG(SJ/8.)
T3=SINA(J)*SINA(J)
T4=T2+T3
T5=.6666667 *T3
T6=T5*T3
T7=SJ+SJ
T8=T7+T7
T9=6.283185 *COSA(J)
T10=6.283185 *SINA(J)
T11=T1*SJ
T14 = .3233333 * (16.0 + 6.0 * T3) + 2.0 * T2
IF (IEC.EQ.-1) GO TO 15
```

C\*\*\* \*\*\*EXTRA CROSS FLOW 1ST TERM OF X(I,I), Y(I,I), Z(I,I)

```

10 ECX(J) = 6.283185 * SINA(J) + 2.0 * SINA(J) * COSA(J) * SJ
   EY(J) = -6.283185 * CCSA(J) + SJ * T14
   ECZ(J) = -8.0 * (1.666667 + T2) * SJ
   IF (IEC) 15,1000,15
15 IF (PF) GO TO 25
   IF (IAC) 30,20,20
C      * AXIS FLOW
20 AX(J)=T10+SINA(J)*COSA(J)*(T7+(T4+2.166667 )*T11/12.)
   AY(J)=T7*T4-T9-(1.+T2-T3-T6)*T11/8.
   T12=T1+T1
   AZ(J)=Y2(J)*T8*(1.-T2+T1*(2.-T12+3.*T2*(1.+T12))/144.)
25 IF (IAC) 30,30,100
C      * CROSS FLOW
30 T13=T1/16.
   CX(J)=T10+2.*SINA(J)*SJ*COSA(J)*(1.-T13*(3.-T5+T2+T2))
   CY(J)=-T9+T7*(2.+T4+T13*(1.-4.777778 *T3+T6+T2*(3.-2.666667 *
1      T3)))
   CZ(J)=-T8*(1.+T2-T13*(1.111111 *T3+T2*(T5-1.)))
100 IF (PF) GO TO 200
   IF (FLG15.LE.0.OR.NLF(K).GT.C) GO TO 1000
200 AXV(J) = T9+T7*(T2-T3)+T11*(T2*(12.*T3-9.)
1      -9. + 23.*T3 - 6.*T3*T3) / 72.
   AYV(J) = T10 + 2.*COSA(J)*SINA(J)*(SJ-T11*(6.*T2+9.-2.*T3)/48. )
   IF (.NOT.PF) GO TO 1000
   AX(J) = AXV(J)
   AY(J) = AYV(J)
1000 RETURN
   END

```

\$IBFTC XYZ2      DEBUG,DECK

C

SUBROUTINE XYZ2

C

C

C

\* COMPUTE X,Y,Z MATRICES USING SIMPSON RULE INTEGRATION

```
COMMON      HEDR(10)      ,CASE      ,NB      ,NNU
1            ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2            ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3            ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4            ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5            ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1            ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2            ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3            ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4            ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1            ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2            ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /ECF/ ECX(500), ECY(500), ECZ(500)
REAL      MN
LOGICAL PF
```

C

```
COMMON /CL/      X1(500),      Y1(500),      X2(500),      Y2(500),      DELS(500),
1            SINA(500), COSA(500), XP(500),      YP(500)
COMMON /TL/      A(500),      B(500),      AX(500),      AY(500),      AZ(500),
1            CX(500),      CY(500),      CZ(500),      AXV(500), AYV(500),
2            VN(500,4), VT(500,4), BON,      YZERO,      IAC,
3            I,      J,      J1,      SJ,      DS,
4            DX,      DY,      NI,      XJ,      YJ,
5            XK,      EEK,      EKK,      K,      PF
```

C

C

C

\* START

\* INITIALIZE

DEBUG NI,I,DX,DY,YJ,X2(I),XJ,Y2(I)

ASSIGN 570 TO K1

IF (FLG15.LE.0.OR.NLF(K).GT.0) GO TO 15

10 ASSIGN 420 TO K1

15 S2=.6666667 \*DS

S1 = .3333333 \* DS

S3 = 8.0/3.0 \* S1

S5 = .3333333 \* S1

S4 = S2+S2

T1=Y2(I)\*Y2(I)

ASSIGN 28 TO K2

ASSIGN 410 TO K3

ASSIGN 570 TO K4

IF (.NOT.PF) GO TO 16

```

        ASSIGN 110 TO K2
        ASSIGN 420 TO K3
        ASSIGN 560 TO K4
C      * NO. OF INTERVAL LCOP
16 CC 1000 IS=1,NI
    XJ=XJ+DX
    YJ=YJ+DY
    T2=YJ*YJ
    T3=X2(I)-XJ
    T4=T3*T3
    T5=(Y2(I)+YJ)**2
    T6=T4+T5
    T7=SQRT(T6)
    T8=T2+T4
    IF(T8.EQ.0.) T8=1.E-6
    T9=(Y2(I)-YJ)**2
    T10=T9+T4
    T21 = SQRT( T1 / T8 )
C      * COMPUTE ELLIPIC INTEGRAL
    XK=4.*YJ*Y2(I)/T6
    CALL ELIP
    IF ( IEC ) 18,575,18
18 IF (IAC) 200,20,20
C      * AXIS FLOW
20 T11=YJ/T7
    IF ( T21.LT.0.01) GO TO 24
    T12 = YJ/Y2(I)
    FV2 = (EKK+EEK*(T1-T8)/T10)/T7
    FV3 = Y2(I)/T10 * T3/T7 * EEK
    F1 = FV3*T12
    F2 = FV2*T12
    FV4 = FV2*T3/Y2(I)
    F3=T11*EEK
    GO TO 26
24 FV2 = 0.
    FV3 = 0.
    FV4 = 0.
C*** **SMALL Y FORMULAS AXISYMMETRIC FLOW
    T23 = T1 / T8**2
    T24 = 2.0 * T4 - T2
    F1 = ( ( 1.570796 * YJ * T3 ) / ( T8**1.5 ) ) *
1 ( 1.0 + ( .75 * ( 3.0 * T2 - 2.0 * T4 ) * T23 ) )
    F2 = ( 1.570796 * YJ * Y2(I) ) * ( T24 / (T8**2.5 ) )
    F3 = 1.570796 * YJ * ( 1.0 + (.25 * T23 * (-T24) ) ) / SQRT(T8 )
26 CONTINUE
    GO TO K2,(28,110)
C      * SIMPSON RULE INTEGRATION
28 IF (IS-1) 30,30,40
C      * FIRST PASS
30 AXS=F1
    AYS=F2
    AZS=F3
    IA=0
    GO TO 110
40 IF (IS-NI) 50,80,50
50 IF (IA) 70,60,70

```

```

C          * EVEN PASS
60  AXS=AXS+4.*F1
    AYS=AYS+4.*F2
    AZS=AZS+4.*F3
    IA=1
    GO TO 110
C          * OCD PASS
70  AXS=AXS+F1+F1
    AYS=AYS+F2+F2
    AZS=AZS+F3+F3
    IA=0
    GO TO 110
C          * LAST PASS
80  IF (J-I) 100,90,100
90  IF (BON.NE.0.0) GO TO 100
    AX(J)=AX(J)-S4*(AXS+F1)
    AY(J)=AY(J)-S2*(AYS+F2)
    AZ(J)=AZ(J)+S4*(AZS+F3)
    GO TO 110
100 AX(J)=-S4*(AXS+F1)
    AY(J)=-S2*(AYS+F2)
    AZ(J)=S4*(AZS+F3)
110 IF (IAC) 200,200,400
C          * CROSS FLOW
200 IF (T21.LT.0.04) GO TO 220
    T12 = T1 + T8
    F1=T3/Y2(I)*(EKK-EKK*T12/T10)/T7
    F2=(EEK*(T8*T8+T1*(T4-T2))/T10-EKK*T8)/T1/T7
    F3=T7*(EKK*T12/T6-EKK)/T1
    GO TO 230
C***      ***SMALL Y FORMULAS      * CROSS FLOW
220 T23 = T1 / T8**2
    T29 = ( 1.570796 * T2 ) / ( T8**1.5 )
    T26 = 4.0 * T4 - T2
    T31 = T26 * T23
    F1 = ( (-4.712389) * T2 * T3 * Y2(I) ) / ( T8**2.5 )
    F2 = T29 * ( 1.0 - (1.125 * T31) )
    F3 = T29 * ( 1.0 - (.375 * T31) )
C          * SIMPSON RULE INTEGRATION
230 IF (IS-I) 240,240,250
C          * FIRST PASS
240 CXS=F1
    CYS=F2
    CZS=F3
    IC=0
    GO TO 400
250 IF (IS-NI) 260,290,260
260 IF (IC) 280,270,280
C          * EVEN PASS
270 CXS=CXS+4.*F1
    CYS=CYS+4.*F2
    CZS=CZS+4.*F3
    IC=1
    GO TO 400
C          * OCD PASS
280 CXS=CXS+F1+F1

```



```

CYS=CYS+F2+F2
CZS=CZS+F3+F3
IC=0
GO TO 400

C      * LAST PASS
290 IF (J-I) 310,300,310
300 IF (BON.NE.0.0) GO TO 310
    CX(J)=CX(J)+S2*(CXS+F1)
    CY(J)=CY(J)+S2*(CYS+F2)
    CZ(J)=CZ(J)+S2*(CZS+F3)
    GO TO 400
310 CX(J)=S2*(CXS+F1)
    CY(J)=S2*(CYS+F2)
    CZ(J)=S2*(CZS+F3)
400 GO TO K3,(410,420)
410 GO TO K1,(570,420)
C*** **FLOW OF CONTROL REACHES HERE FOR (PF=TRUE) OR ( (FLG15 GT 0 AND
C*** **NLF LE 0 (LIFTING BODY)) AND (I NE J ON BODY OR ANY OFF BODY) )
420 FV1 = (T2-T1)/T7 * EEK/T10
    IF (IS.GT.1) GO TO 440

C      * FIRST PASS
    AX1 = FV1
    AX2 = FV2
    AY1 = FV3
    AY2 = FV4
    IV=0
    GO TO 570
440 IF (IS.EQ.NI) GO TO 500
    IF (IV) 460,450,460

C      * EVEN PASS
450 AX1 = AX1+4.*FV1
    AX2 = AX2+4.*FV2
    AY1 = AY1+4.*FV3
    AY2 = AY2+4.*FV4
    IV=1
    GO TO 570

C      * ODD PASS
460 AX1 = AX1+FV1+FV1
    AX2 = AX2+FV2+FV2
    AY1 = AY1+FV3+FV3
    AY2 = AY2+FV4+FV4
    IV = 0
    GO TO 570

C      * LAST PASS
500 IF (J-I) 540,520,540
520 IF (BON.NE.0.) GO TO 540
    AXV(J) = AXV(J) - S4*(AX1+FV1) - S2*(AX2+FV2)
    AYV(J) = AYV(J) - S4*(AY1+FV3) + S2*(AY2+FV4)
    GO TO 550
540 AXV(J) = -S4*(AX1+FV1) -S2*(AX2+FV2)
    AYV(J) = -S4*(AY1+FV3) +S2*(AY2+FV4)
550 GO TO K4,(560,570)
C*** **FLOW OF CONTROL REACHES HERE IF PF IS TRUE
560 AX(J) = AXV(J)
    AY(J) = AYV(J)
570 IF (IEC.EQ.-1) GO TO 1000

```

```

575 IF (T21.LT.0.08)GO TO 595
580 T20 = SQRT( T2 / (T1 + T4) )
    IF (T20.LT.0.01) GO TO 590
    T13 = YJ * Y2(I)**3
    T14 = T1 + T8
    T15 = T2 * T1
    T16 = T14 * T14
    T17 = T1 * YJ
    T18 = T1 * T1
    T19 = T8 * T8
    F3 = ( T7/T13 ) * ( (-T14) * EEK + ( ( T16 - T15 ) * EKK ) / T6 ) )
    F1 = (T3 / (T17 * T7) ) * ( (EEK / T10 ) * (T16 - 3.0 * T15) -
1    (T14 * EKK) )
    TEMP1 = ((-8.0*T8**3) - (12.0*T1*T19) + (26.0*T15*T8)
1    + (2.0*T18*(2.0*T1 - 5.0*T2) ))* EEK/T10
    TEMP2 = EKK * ( (8.0*T19) + (4.0*T1*T8) - (2.0*T15) - (4.0*T18) )
    F2 = (TEMP1 + TEMP2) / ( T13 * T7)
    GO TO 630
C***   ***SMALL YJ FORMULAS   *   EXTRA CROSS FLOW
590 T25 = YJ**3
    T30 = T4 + T1
    T27 = T30**3.5
    T28 = T25 * Y2(I)
    F1 = ( 2.945243 * T25 * T3 * T1 ) / T27
    F2 = 7.068584 * T28 * ( 3.0 * T1 - 2.0 * T4 ) / T27
    F3 = 1.767146 * T28 / (T30**2.5 )
    GO TO 630
C***   ***SMALL Y FORMULAS   *   EXTRA CROSS FLOW
595 T25 = YJ**3
    F1 = ( 2.945243 * T25 * T3 * T1 ) / ( T8**3.5 )
    F2 = ( (-14.13717) * T25 * Y2(I) ) / (T8**2.5)
    F3 = -F2 / 8.0
C***   ***SIMPSON'S RULE
630 IF (IS - 1) 640,640,650
C***   ***FIRST PASS
640 ECXS = F1
    ECYS = F2
    ECZS = F3
    IE = 0
    GO TO 1000
650 IF (IS - NI) 660,690,660
660 IF ( IE ) 680,670,680
C***   ***EVEN PASS
670 ECXS = ECXS + 4.0 * F1
    ECYS = ECYS + 4.0 * F2
    ECZS = ECZS + 4.0 * F3
    IE = 1
    GO TO 1000
C***   ***ODD PASS
680 ECXS = ECXS + F1 + F1
    ECYS = ECYS + F2 + F2
    ECZS = ECZS + F3 + F3
    IE = 0
    GO TO 1000
C***   ***LAST PASS
690 IF (J - I) 710,700,710
C***   ***I=J   *   ELEMENTS ON MAIN DIAGONAL
700 IF (BON.NE.0.0) GO TO 710
    ECX(J) = ECX(J) -S4 * ( ECXS + F1 )
    ECY(J) = ECY(J) -S5 * ( ECYS + F2 )
    ECZ(J) = ECZ(J) +S3 * ( ECZS + F3 )
    GO TO 1000
C***   ***OFF MAIN DIAGONAL OR OFF BODY POINTS
710 ECX(J) = -S4 * ( ECXS + F1 )
    ECY(J) = -S5 * ( ECYS + F2 )
    ECZ(J) = S3 * ( ECZS + F3 )
1000 CONTINUE
    RETURN
    END

```

\$IBFTC ELIP DECK

C

SUBROUTINE ELIP

C

C

C

\* HASTINGS APPROXIMATION FOR ELLIPTIC INTERGALS

```

COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,NC(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
LOGICAL PF

```

C

```

COMMON /CL/  X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TL/  A(500), B(500), AX(500), AY(500), AZ(500),
1           CX(500), CY(500), CZ(500), AXV(500), AYV(500),
2           VN(500,4), VT(500,4), BON, YZERO, IAC,
3           I, J, J1, SJ, DS,
4           DX, CY, NI, XJ, YJ,
5           XK, EEK, EKK, K, PF

```

C

C

```

* START
ETA = 1. - XK
IF (ETA) 20,20,40
20 WRITE (6,30) ETA
30 FORMAT ( 1H1 36H *** ERROR IN SUBROUTINE ELIP * ETA= F15.8 )
WRITE(6,800) I,XJ,DX,YJ,DY,X2(I),Y2(I),XK
800 FORMAT(1H ,15,7F15.6)
ETA = 0.000005
40 ELN=ALOG(ETA)
EEK = 1.386294E0 + ETA * (.9666344E-1 + ETA *
1 (.3590092E-1 + ETA * (.3742564E-1 + ETA *
2 (.1451196E-1 ))) - ELN * (.5 + ETA * (.1249859E0 +
3 ETA * (.6880249E-1 + ETA * (.3328355E-1 + ETA *
4 .4417870E-2 )))
EEK = 1. + ETA * (.4432514E0 + ETA * (.6260601E-1 + ETA *
1 (.4757384E-1 + ETA * .1736506E-1 ))) - ELN * (ETA *
2 (.2499837E0 + ETA * (.9200180E-1 + ETA *
3 (.4069698E-1 + ETA * .5264496E-2 )))
RETURN
END

```

\$IBFTC PAT2 DECK

SUBROUTINE PART2

```

C
C      * COMPUTE SOURCE DENSITY SIGMA BY SIEDEL ITERATION
C
COMMON HEDR(10) ,CASE ,NB ,NNU ,FLG07
1      ,FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
2      ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
3      ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
4      ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
5      ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
1      ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
2      ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
3      ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
4      ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
COMMON NT ,NC(11) ,MN ,NUNA(4) ,TYPEA(4)
1      ,NER1 ,NER2 ,NMA ,NSIGA ,NSIGC
2      ,NUNC(4) ,TYPEC(4) ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL MN

C
COMMON /C2/ A(500), R(500,4), NSIG, IT
C
DIMENSION ASIG(500,4), CSIG(500,4), T(500)
C
C      * START
C      IF (FLG03.EQ.0) GO TO 1000
C      * AXIS FLOW
C      L=0
C      READ (4) (T(I),I=1,NT)
C      IF (FLG16.NE.0) GO TO 200
C      L=L+1
C      DO 100 I = 1, NT
100  R(I,L) = T(I)
200  IF (NNU) 600,600,300
300  DO 500 J = 1, NNU
C      * READ NON-UNIFORM NO * SKIP TO
C      READ (4) MS,(T(I),I=1,NT)
C      IF (MS.EQ.1) GO TO 500
C      L=L+1
C      DO 400 I = 1, NT
400  R(I,L) = T(I)
500  CONTINUE
600  REWIND 4
C      IT = 9
C      NSIG = NSIGA
C      * SOLVE SIMULTANEOUS EQUATIONS FOR SIGMAS
C      CALL MISNA2 (ASIG)
C      REWIND 9
C      IF (FLG04.GT.0) GO TO 1000
C      * WRITE SIGMAS ON TAPE 3
C      DO 700 J = 1, NSIGA
700  WRITE (3) (ASIG(I,J), I = 1, NT)

```

```

      RETURN
C      * CROSS FLOW
1000 L = 0
      READ (4) (T(I),I=1,NT),(T(I),I=1,NT)
      IF (FLG17.NE.0) GO TO 1200
      L = L+1
      DO 1100 I = 1, NT
1100 R(I,L) = -T(I)
1200 IF (NNU) 1600,1600,1300
1300 DO 1500 J = 1, NNU
      READ (4) MS,(T(I),I=1,NT)
      IF (MS.LE.0) GO TO 1500
      L = L+1
      DO 1400 I = 1, NT
1400 R(I,L) = T(I)
1500 CONTINUE
1600 REWIND 4
      IT = 10
      NSIG = NSIGC
C      * SOLVE SIMULTANEOUS EQUATIONS FOR SIGMAS
      CALL MISNA2 (CSIG)
      REWIND 10
      IF (FLG03.LE.0) GO TO 1675
C      * WRITE SIGMAS ON TAPE 3
      DO 1650 J = 1, NSIGA
1650 WRITE (3) (ASIG(I,J),I=1,NT)
1675 DO 1700 J = 1, NSIGC
1700 WRITE (3) (CSIG(I,J),I=1,NT)
      RETURN
      END

```

\$IBFTC MISN DECK

C

SUBROUTINE MISNA2 (SIG)

C

C

C

\* SOLVE LINEAR SIMULTANEOUS EQUATIONS BY SEIDEL ITERATION

```

COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
REAL      MN

```

C

```

COMMON /C2/  A(500),  R(500,4),      NSIG,      IT

```

C

```

DIMENSION  SIG(500,4),  KFLAG(4), DSIG1(4), DSIG(500,4)

```

C

C

C

\* START  
\* INITIALIZE

```

10 NTU=0
ITER=0
NCONV=0
DO 20 J=1,NSIG
KFLAG(J)=0
DO 20 I=1,NT
20 SIG(I,J)=0.0
30 DO 35 I=1,NSIG
35 DSIG1(I)=0.0

```

C

\* COMPUTE SIGMA AND DELTA SIGMA

```

DO 300 I=1,NT
IF (NTU-3) 40,100,110
40 IF (FLG12.NE.0) GO TO 60

```

C

\* PLACE A IN LEFT SIDE MATRIX

```

IF (IT.EQ.10) GO TO 50
READ (9) (A(L),L=1,NT)
GO TO 80

```

```

50 READ (10) (A(L),L=1,NT)
GO TO 80

```

C

\* PLACE PHI IN LEFT SIDE MATRIX

```

60 IF (IT.EQ.10) GO TO 70
READ (9) (A(L),L=1,NT),(A(L),L=1,NT),(A(L),L=1,NT)

```

```

      GO TO 80
70  READ (10) (A(L),L=1,NT),(A(L),L=1,NT),(A(L),L=1,NT)
C    * SAVE LEFT SIDE MATRIX
80  WRITE (3) (A(L),L=1,NT)
     WRITE (11) (A(L),L=1,NT)
     GO TO 200
C    * READ LEFT SIDE MATRIX
100 READ (3) (A(L),L=1,NT)
     GO TO 200
110 READ (11) (A(L),L=1,NT)
200  DO 300 J=1,NSIG
     IF (KFLAG(J).NE.0) GO TO 300
     SUM=0.0
     DO 210 L=1,NT
210  SUM=SUM+A(L)*SIG(L,J)
     DSIG(I,J)=(R(I,J)-SUM)/A(I)
     IF (FLG09.NE.0) GO TO 220
     SIG(I,J)=SIG(I,J)+DSIG(I,J)
220  IF (ABS(DSIG(I,J)).GT.DSIG1(J)) DSIG1(J)=ABS(DSIG(I,J))
300  CONTINUE
     IF (FLG09.LE.0) GO TO 320
     DO 310 J=1,NSIG
     DO 310 I=1,NT
310  SIG(I,J)=SIG(I,J)+DSIG(I,J)
C    * TEST FOR SOLUTION
320  REWIND 3
     REWIND 11
     ITER=ITER+1
     DO 400 J=1,NSIG
     IF (KFLAG(J).NE.0) GO TO 400
     IF (DSIG1(J).GE.1.E-6) GO TO 400
     KFLAG(J)=ITER
     NCCNV=NCCNV+1
     IF (NCCNV.EQ.NSIG) GO TO 600
400  CONTINUE
     IF (ITER.EQ.100) GO TO 600
     IF (NTU.EQ.3) GO TO 500
     NTU=3
     GO TO 30
500  NTU=11
     GO TO 30
C    * PRINT NO. OF ITERATIONS
600  DO 800 J=1,NSIG
     IF (KFLAG(J).NE.0) GO TO 700
     WRITE (6,610)
610  FORMAT (1H0 7X 36H NO CONVERGENCE AFTER 100 ITERATIONS )
     GO TO 800
700  WRITE (6,710) KFLAG(J)
710  FORMAT (1H0 5X 15,1X 36H ITERATIONS REQUIRED FOR CONVERGENCE )
800  CONTINUE
     RETURN
     END

```

SIBFTC PREP DECK

```

SUBROUTINE PREP
C **      * PREPARE TAPES 3 AND 11 FOR USE BY LINK 5 (MATSOL)
COMMON/SPACER/WKAREA(16000)
DIMENSION TEMP(504), Y2(500)
COMMON      HEDR(10) ,CASE      ,NB      ,NNU      ,FLG07
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG12
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG17
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG22
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG27
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,
CCUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
DIMENSION COSSQR(500), RHS(500)
DIMENSION A(504),R(500,4),FF(500),T(500)
DATA FOURPI/12.5663706/
C***      ***AXISYMMETRIC FLOW ONLY      MS = 0
C***      ***CROSS FLOW ONLY      MS = 1
C***      ***EXTRA CROSS FLOW ONLY      MS = 2
C***      ***AXISYMMETRIC AND CROSS FLOW      MS = 3
C***      ***AXISYMMETRIC AND EXTRA CROSS FLOW      MS = 4
C***      ***CROSS AND EXTRA CROSS FLOW      MS = 5
C***      ***AXISYMMETRIC,CROSS, AND EXTRA CROSS FLOW      MS = 6
IF (FLG12.EQ.0.OR.(FLG04.EQ.0.AND.FLG21.EQ.0) ) GO TO 3
IF (FLG05.EQ.0) GO TO 4
C***      ***SKIP CFF BODY COORDINATES
READ(12)
4 NI=NT+NB
READ(12) (TEMP(I),I = 1,NI),(TEMP(I),I = 1,NI),
1 (TEMP(I),I = 1,NT), (Y2(I),I = 1,NT)
REWIND 12
3 REWIND 3
IF (FLG03) 5,800,5
C **      * PREPARE AXISYMMETRIC MATRIX TAPE (3)
5 IF (FLG19.GT.0) GO TO 2000
IF ( FLG22.GT.0) GO TO 255
K = 0
L = NT+NSIGA
READ (4) (A(I),I=1,NT),(FF(I),I=1,NT)
IF (FLG16.NE.0) GO TO 20
K = K+1
DO 10 I = 1, NT
10 R(I,K) = A(I)
20 IF (NNU) 60,60,30
30 DO 50 J = 1, NNU
READ (4) MS,(A(I),I=1,NT)

```



```

IF (MS.EQ.1.OR.MS.EQ.2.OR.MS.EQ.5) GO TO 50
K = K+1
DO 40 I = 1, NT
40 R(I,K) = A(I)
50 CONTINUE
60 IF (FLG14.LE.0) GO TO 290
NR= NMA+1
READ (4) (R(I,1), I=NR,NT)
REWIND 4
DO 220 I = NR, NT
220 R(I,1) = R(I,1)-FF(I)
IF (FLG14.EQ.NB) GO TO 245
DO 240 I = 1, NMA
READ (9) (A(J),J=1,NT)
A(NT+1) = R(I,1)
240 WRITE (3) (A(J),J=1,L)
245 DO 250 I = NR, NT
READ (9) (A(J),J=1,NT),(A(J),J=1,NT)
A(NT+1) = R(I,1)
250 WRITE (3) (A(J),J=1,L)
C PRESCRIBED TANGENTIAL VELOCITY INPUT TO SOLVIT ON TAPE 3
C OUTPUT FROM SOLVIT ON TAPE 3
C TAPES 1 AND 2 ARE SCRATCH TAPES
CALL SOLVIT(WKAREA,NT,NSIGA,16000,3,1,2,3,+9010)
REWIND 9
GO TO 800
C*** ***AXISYMMETRIC FLOW * GENERATED (RESEP) BOUNDARY CONDITIONS
C*** ***NPB1 = THE NUMBER OF ELEMENTS ON BODY 1
C*** ***NPB2 = THE NUMBER OF ELEMENTS ON BODY 2
255 NPB1 = ND(1) - 1
NPB2 = ND(2) - 1
NSIGA = 3
NSIGC = 1
NSIGEC = 1
L = NT + NSIGA
C*** ***L IS THE TOTAL WIDTH OF THE MATRIX FOR AXISYMMETRIC FLOW INCL
C*** ***RIGHT HAND SIDES
READ (4)
READ(4) ( COSSQR(I),I = 1,NPB1), (RHS(I),I = 1,NPB1 )
REWIND 4
DO 260 I = 1,NPB1
R(I,1) = 0.0
R(I,2) = 1.0
260 R(I,3) = COSSQR(I)
NBEGIN = NPB1 + 1
NEND = NPB1 + NPB2
DO 265 I = NBEGIN,NEND
R(I,1) = 1.0
R(I,2) = 0.0
265 R(I,3) = 0.0
290 REWIND 4
ASSIGN 400 TO M
IF (FLG12.NE.0) ASSIGN 300 TO M
DO 700 I = 1, NT
GO TO M, (300,400)
300 READ (9) (A(J),J=1,NT),(A(J),J=1,NT),(A(J),J=1,NT)

```

```

      GO TO 500
400 READ (9) (A(J),J=1,NT)
500 DO 600 J = 1, NSIGA
      K = NT+J
600 A(K) = R(I,J)
700 WRITE (3) (A(J),J=1,L)
C  AXISYMMETRIC FLOW          INPUT TO SOLVIT ON TAPE 3
C                               OUTPUT FROM SOLVIT ON TAPE 3
C  TAPES 1 AND 2 ARE SCRATCH TAPES
      CALL SOLVIT(WKAREA,NT,NSIGA,16000,3,1,2,3,+9020)
      REWIND 9
C **          * PREPARE CROSSFLOW MATRIX TAPE (11)
C **          * SKIP SINA * READ COSA
800 IF (FLG04.EQ.0) GO TO 1610
      K = 0
      L = NT+NSIGC
      IF (FLG22.GT.0) GO TO 910
      READ (4) (A(I),I=1,NT),(A(I),I=1,NT)
      IF (FLG17.NE.0) GO TO 820
      K = K+1
      DO 810 I = 1, NT
810 R(I,K) = A(I)
820 IF (NNU) 900,900,830
830 DO 850 J = 1, NNU
      READ (4) MS,(A(I),I=1,NT)
      IF (MS.EQ.0.OR.MS.EQ.2.OR.MS.EQ.4) GO TO 850
      K = K+1
      DO 840 I = 1, NT
840 R(I,K) = -A(I)
850 CONTINUE
900 REWIND 4
      GO TO 1000
C***  ***CROSS FLOW  *  GENERATED (RESEP) BOUNDARY CONDITIONS
910 DO 920 I = 1,NPBI
920 R(I,1) = -RHS(I)
      DO 930 I = NBEGIN,NEND
930 R(I,1) = 0.0
1000 ASSIGN 1300 TO M
      IF (FLG12.NE.0) ASSIGN 1200 TO M
      DO 1600 I = 1, NT
      GO TO M, (1200,1300)
1200 READ (10) (A(J),J=1,NT),(A(J),J=1,NT),(A(J),J=1,NT)
C***  ***FORM PHI MATRIX FROM THETA (CROSS FLOW) MATRIX
      DO 1250 J = 1,NT
1250 A(J) = Y2(I) * A(J)
      GO TO 1400
1300 READ (10) (A(J),J=1,NT)
1400 DO 1500 J = 1, NSIGC
      K = NT+J
1500 A(K) = -R(I,J)
1600 WRITE (11) (A(J),J=1,L)
C  CROSS FLOW          INPUT TO SOLVIT ON TAPE 11
C                               OUTPUT FROM SOLVIT ON TAPE 3
C  TAPES 1 AND 2 ARE SCRATCH TAPES
      CALL SOLVIT(WKAREA,NT,NSIGC,16000,11,1,2,3,+9030)
      REWIND 10

```

```

1610 CONTINUE
C***   ***EXTRA CROSS FLOW
      REWIND 11
      IF (FLG21.EQ.0.AND.FLG22.EQ.0)RETURN
      K = 0
      L = NT + NSIGEC
      IF (FLG22.GT.0) GO TO 1800
C***   ***EXTRA CROSS FLOW *   NCN-UNIFORM FLOW ONLY
C***   ***SKIP RECORD WITH SINES AND COSINES
      READ (4)
      DO 1650 J=1,ANNU
      READ(4) MS, (A(I),I=1,NT)
      IF (MS.LT.2.OR.MS.EQ.3) GO TO 1650
      K = K+ 1
      DO 1640 I = 1,NT
1640  R(I,K) = A(I)
1650  CONTINUE
      GO TO 1900
C***   ***EXTRA CROSS FLOW *   GENERATED (RESEP) BOUNDARY CONDITIONS
1800  DO 1820 I = 1,NPB1
1820  R(I,1) = COSSQR(I)
      DO 1840 I = NBEGIN,NEND
1840  R(I,1) = 0.0
1900  REWIND 4
C***   ***M IS 1920 *   SOLVE A MATRIX
      ASSIGN 1920 TO M
C***   ***M IS 1940 *   SOLVE POTENTIAL MATRIX
      IF (FLG12.NE.0)ASSIGN 1940 TO M
      DO 1980 I = 1,NT
      GO TO M, (1920,1940)
C***   ***SOLVE A MATRIX
1920  READ (8) (A(J),J =1,NT)
      GO TO 1960
1940  READ (8) (A(J),J=1,NT),(A(J),J=1,NT),(A(J),J=1,NT)
C***   ***FORM PHI MATRIX FROM THETA (EXTRA CROSS FLOW) MATRIX
      DO 1950 J = 1,NT
1950  A(J) = Y2(I) * A(J) / 2.0
1960  DO 1970 J = 1,NSIGEC
      K = NT + J
1970  A(K) = R(I,J)
1980  WRITE (11) (A(J),J=1,L)
C***   ***EXTRA CROSS FLOW   INPUT TO SOLVIT ON TAPE 11
C***   ***OUTPUT FROM SOLVIT ON TAPE 3
C***   ***TAPES 1 AND 2 ARE SCRATCH TAPES
      CALL SOLVIT (WKAREA,NT,NSIGEC,16000,11,1,2,3,+9040)
      REWIND 8
      REWIND 11
      RETURN
2000  NR = NT-NMA
      L = NMA+1
      READ (4) (R(I,1),I=1,NMA)
      READ (4) (FF(I),I=1,NR)
      DO 2100 I = 1, NR
2100  FF(I) = FF(I)/FCURPI
      EACKSPACE 4
      WRITE (4) (FF(I),I=1,NR)

```

```

REWIND 4
CC 2300 I = 1, NMA
READ (9) (A(J),J=1,NMA),(T(J),J=1,NR)
CC 2200 J = 1, NR
2200 R(I,1) = R(I,1) - T(J)*FF(J)
    A(L) = R(I,1)
2300 WRITE (3) (A(J),J=1,L)
C   PRESCRIBED VORTICITY      INPUT FOR SOLVIT ON TAPE 3
C   OUTPUT FROM SOLVIT ON TAPE 3
C   TAPES 1 AND 2 ARE SCRATCH TAPES
    CALL SOLVIT(WKAREA,NMA,L - NMA,16000,3,1,2,3,+9000)
    REWIND 9
    GO TO 800
9000 WRITE(6,9001)
9001 FORMAT(61H NOT ENOUGH SPACE RESERVED IN SOLVIT FOR PRESCRIBED VORT
    ICITY)
    GO TO 9080
9010 WRITE(6,9011)
9011 FORMAT(71H NOT ENOUGH SPACE RESERVED IN SOLVIT FOR PRESCRIBED TANG
    ENTIAL VELOCITY)
    GO TO 9080
9020 WRITE (6,9021)
9021 FORMAT(58H NOT ENOUGH SPACE RESERVED IN SOLVIT FOR AXISYMMETRIC FL
    ICW)
    GO TO 9080
9030 WRITE(6,9031)
9031 FORMAT(51H NOT ENOUGH SPACE RESERVED IN SOLVIT FOR CROSS FLOW)
    GO TO 9080
9040 WRITE (6,9041)
9041 FORMAT (57H NOT ENOUGH SPACE RESERVED IN SOLVIT FOR EXTRA CROSS FL
    ICW)
9080 STOP
    END

```

\$IBFTC SOLV     DEBUG,DECK

C20X9

SUBROUTINE SOLVIT (A, NC, MC, KD, NI, MM, NO, NW, \*)

```

      ****      ***/      ****      ****      *      ***/      *
      *      *      * / *      *      *      *      * / *      *
****      ****      * / *      *      ***      *      * / *      ****      *
      *      * / *      *      *      *      * / *      *
      *      /***      *      *      *****      /***      *

```

DIRECT MATRIX SOLUTION

WRITTEN BY J. L. HESS \* PROGRAMMED BY T. M. RIDDELL

DIMENSION A ( KD )

LOGICAL LAST

CALL TIMEV(AA1)

N = NO

M = MO

KORE = KD

NPM = N + M

IF (MAXO(3 \* NPM, M \* N) .GT. KORE) RETURN 1

MT = MM

REWIND MT

NIN = NI

DEBUG NIN,NI,NO

REWIND NIN

NOUT = NO

REWIND NOUT

MPI = M + 1

NN = N

NEL = NPM

- - CALCULATE THE MAXIMUM NO. OF ROWS, 'K'

10 K = (KORE - NEL) / NEL

- - TEST TO SEE IF THE REST OF THE MATRIX WILL FIT IN CORE

LAST = K .GE. NN

IF (LAST) K = NN

- - READ 'K' ROWS OF THE AUGMENTED 'A' MATRIX

30 NT = 0

CO 40 IB = 1, K

NS = NT + 1

NT = NT + NEL

```

      40 READ (NIN) (A(IO), IC = NS, NT)
C
C - - CHECK TO SEE IF WE WERE UNLUCKY ENOUGH TO END UP WITH ONLY ONE ROW
C
      IF (K .EQ. 1) GO TO 90
C
C - - 'K' IS GREATER THAN '1' SO WE CAN START THE TRIANGULARIZATION
C
      NELP1 = NEL + 1
      NS = - NEL
      NELP2 = NELP1 + 1
C
C - - FORM THE 'TRAPEZOIDAL' ARRAY (8)
C
      DO 50 IB = 2, K
      NP = NELP2 - IB
      NS = NS + NELP1
      NT = NS
      DO 50 IC = IB, K
      NT = NT + NEL
      MN = NT
      NB = NS
      A(NT) = (-A(NT)) / A(NS)
      DO 50 NF = 2, NP
      MN = MN + 1
      NB = NB + 1
      50 A(MN) = A(MN) + A(NT) * A(NB)
      IF (LAST) GO TO 90
C
C - - WRITE THE 'TRAPEZOIDAL' MATRIX ON TAPE
C
      NT = 0
      NP = NEL
      NS = - NEL
      DO 60 IO = 1, K
      NS = NS + NELP1
      NT = NT + NEL
      WRITE (MT) NP, (A(IB), IB = NS, NT)
      60 NP = NP - 1
      NP = NP - M
      NS = KORE - NEL + 1
C
C - - READ ANOTHER ROW
C
      DO 80 IC = 1, NP
      READ (NIN) (A(IB), IB = NS, KORE)
C
C - - MODIFY THIS ROW BY THE 'TRAPEZOIDAL' ARRAY
C
      NT = 1
      MN = NS
      DO 70 IB = 1, K
      NB = NT
      NF = MN + 1
      A(MN) = (-A(MN)) / A(NT)
      DO 65 NN = NF, KORE

```

```

      NB = NB + 1
65  A(NN) = A(NN) + A(MN) * A(NB)
      MN = NF
70  NT = NT + NELP1
C
C - - WRITE THE MODIFIED ROW ON TAPE
C
      80 WRITE (NOUT)      (A(NT), NT = MN, KORE)
      REWIND NOUT
      REWIND NIN
C
C - - SWITCH THE TAPES
C
      NT = NIN
      NIN = NOUT
      NOUT = NT
C
C - - RE-CALCULATE ROW LENGTH AND LOOP BACK
C
      NEL = NEL - K
      NN = NEL - M
      GO TO 10
C
C - - REWIND ALL TAPES
C
      90 REWIND MT
      REWIND NIN
      REWIND NOUT
C
C - - CONDENSE THE MATRIX
C
      NN = NEL
      NL = NELP1
      IF (K .EQ. 1) GO TO 105
      NS = 1
      NT = NEL
      DO 100 IB = 2, K
      NS = NS + NELP1
      NT = NT + NEL
      DO 100 IO = NS, NT
      A(NL) = A(IO)
100  NL = NL + 1
105  N1 = KORE - K * M + 1
C
C - - THERE, NOW WE CAN START THE BACK-SOLUTION
C * * NOTE..THE FIRST AVAILABLE LOCATION FOR THE SOLUTIONS IS A(N1)
C
      NREM = N
      NEL = NPM
      LAST = K .EQ. N
      NPASS = 0
C
C - - SOLVE FOR THE ANSWERS CORRESPONDING TO 'K' ROWS
C
      110 KM1 = K - 1
      KP1 = K + 1

```

```

NS = NL - MP1
NPASS = NPASS + 1
DO 130 MN = 1, M
NF = NS + MN
A(NF) = A(NF) / A(NS)
NT = NS
IF (KM1 .EQ. 0) GO TO 130
DO 125 IB = 1, KM1
NF = NF - IB - M
NT = NT - MP1 - IB
SUM = 0.0
NP = NF
N2 = MP1 + IB
DO 120 IO = 1, IB
NN = NT + IO
NP = NP + N2 - IO
120 SUM = SUM + A(NN) * A(NP)
125 A(NF) = (A(NF) - SUM) / A(NT)
130 CONTINUE
C
C - - MOVE THE SOLUTIONS TO CONTIGUOUS LOCATIONS STARTING AT A(N1)
C
N1 = KORE + 1
DO 140 NN = 1, K
DO 135 MN = 1, M
NL = NL - 1
N1 = N1 - 1
135 A(N1) = A(NL)
140 NL = NL - NN
C
C - - WRITE THE SOLUTIONS ON TAPE
C
WRITE (NIN) K
NS = N1 - 1
DO 145 MN = 1, M
NT = NS + MN
145 WRITE (NIN) (A(IO), IO = NT, KORE, M)
C
C - - TEST IF THIS IS THE LAST PASS
C
IF (LAST) GO TO 200
C
C - - WE MUST NOW MODIFY THE TRIANGULAR MATRIX TO REFLECT THE EFFECT OF
C THE SOLUTIONS OBTAINED SO FAR (EQ 21)
C * * NOTE..LOCATIONS A(1) TO A(N1-1) ARE NOW FREE TO USE
C
C - - CALCULATE THE NEXT VALUES OF 'NEL' AND 'NREM'
C
NELOLD = NEL
KOLD = K
NEL = NEL - K
NREM = NREM - K
C
C - - NOW APPLY THE INCREDIBLE FORMULA FOR THE NEW 'K'
C
K = (-4 * M - 1) / 2 + IFIX(SQRT(0.25 + FLOAT((4 * M + 2) * M +

```



```

1 2 * (KORE - NELOLD)))
NROW = NREM - K + 1
IF (K .LT. NREM) GO TO 150
LAST = .TRUE.
NROW = 1
K = NREM
150 NS = 1
NT = NELOLD + 1

C
C - - READ IN THE ROWS TO BE MODIFIED
C
DO 190 IB = 1, NREM
NT = NT - 1
IF (IB .LE. NROW) GO TO 160
NS = NS + NN
NT = NT + NN
160 READ ( MT ) NN, (A(IC), IO = NS, NT)
NP = N1 - 1
NF = NT - M - KM1
NN = NN - KOLD
DO 170 MN = 1, M
N2 = NF
NA = NP + MN
NB = NA
SUM = 0.0
DO 165 IO = 1, KOLD
SUM = SUM + A(N2) * A(NA)
N2 = N2 + 1
165 NA = NA + M
N2 = N2 + MN - 1
170 A(N2) = A(N2) - SUM

C
C - - WRITE THE MODIFIED ROW ON TAPE OR CONDENSE THE ROW
C
NL = NT - M + 1
IF (IB .GE. NROW) GO TO 175
NF = NL - KP1
WRITE (NOUT) NN, (A(IC), IO = NS, NF), (A(IO), IO = NL, NT)
GO TO 190
175 NF = NL - KOLD
DO 180 MN = NL, NT
A(NF) = A(MN)
180 NF = NF + 1
190 CONTINUE
REWIND MT
REWIND NOUT

C
C - - SWITCH THE TAPES
C
NT = MT
MT = NOUT
NOUT = NT

C
C - - LOOP BACK THRU THE SOLUTION
C
NL = NF

```

```

      GO TO 110
C
C -- START TO WRAP IT UP
C
200 REWIND NIN
   N2 = N
C
C * * NOTE.. AT THIS POINT ALL LOCATIONS A(1) THRU A(KORE) ARE FREE
C
      DO 220 IB = 1, NPASS
      READ (NIN) K
      N1 = N2 - K + 1
      NS = N1
      NT = N2
C
C -- READ IN THE SOLUTIONS
C
      DO 210 IO = 1, M
      READ (NIN) (A(NN), NN = NS, NT)
      NT = NT + N
210  NS = NS + N
220  N2 = N1 - 1
C
C --- REWIND ALL INPUT TAPES
      REWIND NIN
      REWIND MT
      REWIND NOUT
C -- WRITE THE SOLUTIONS ON TAPE
C
      NT = 0
      DO 230 IO = 1, M
      NS = NT + 1
      NT = NT + N
230  WRITE (NW) (A(NN), NN = NS, NT)
C
      CALL TIMEV(AA2)
      EB = (AA2 - AA1) / 60.
      WRITE (6, 300) N, N, M, EB
300  FORMAT (4H0THE 15, 2H X 15, 12H MATRIX WITH 14, 35H RIGHT SIDES WA
1S SOLVED DIRECTLY IN F8.3, 9H MINUTES. )
      RETURN
      END

```

\$IBFTC PAT4 DECK

C

SUBROUTINE PART4

C

C

C

\* COMPUTE VELOCITY COMPONENTS AND PRINT

```
COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
REAL      MN
```

C

```
COMMON /C4/      X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TC/      RB(500,8), SIG(500,4),      A(500),      B(500),      Z(500),
1           PHI(500,4),      XN(500,4),
2           T(500,4), T3(500,4),      NSIG,      NP, NI, SUMV
```

C

C

\* START

REWIND 3

IF (FLG05.EQ.0) GO TO 30

C

\* READ OFF-BCCY XP,YP

NP=ND(NB+1)

READ (12) (XP(I),I=1,NP),(YP(I),I=1,NP)

C

\* READ X1,Y1,X2,Y2,DELS WITH MACH NO. ADJUSTMENT IF ANY

30 NI=NT+NB

READ (12) (X1(I),I=1,NI),(Y1(I),I=1,NI),(X2(I),I=1,NT)

1 ,(Y2(I),I=1,NT),(DELS(I),I=1,NT)

C

\* READ SINA,COSA,NO,TO..

READ (4) (A(I),I=1,NT),(B(I),I=1,NT)

SUMV = 0.0

DO 100 I = 1, NT

SINA(I) = A(I)

COSA(I) = B(I)

100 SUMV = SUMV + B(I)\*DELS(I)\*Y2(I)\*\*2

SUMV = SUMV\*3.141593

IF (FLG03.LE.0) GO TO 1000

L = 1

LS = 0

IF (FLG16.NE.0) GO TO 200

DO 150 I = 1, NT

RB(I,L) = A(I)

150 RB(I,L+1) = B(I)

```

200 IF (NNU) 600,600,300
300 DO 500 J = 1, NNU
    READ (4) MS, (A(I), I=1, NT), (B(I), I=1, NT)
    IF (MS.EQ.1.OR.MS.EQ.2.OR.MS.EQ.5) GO TO 500
    L = L+2
    LS = LS+1
    IF (LS.EQ.1.AND.FLG16.GT.0) L=L-2
    DO 400 I = 1, NT
        RB(I,L) = A(I)
400 RB(I,L+1) = B(I)
500 CONTINUE
600 REWIND 4
    NSIG = NSIGA
    CALL AXIS
1000 IF (FLG04.LE.0) GO TO 2000
    IF (FLG03.LE.0) GO TO 1050
    READ (4) (A(I), I=1, NT), (B(I), I=1, NT)
1050 L = 1
    LS=0
    IF (FLG17.NE.0) GO TO 1200
    DO 1100 I = 1, NT
        RB(I,L) = A(I)
1100 RB(I,L+1) = B(I)
1200 IF (NNU) 1600,1600,1300
1300 DO 1500 J = 1, NNU
    READ (4) MS, (A(I), I=1, NT), (B(I), I=1, NT)
    IF (MS.EQ.0.OR.MS.EQ.2.OR.MS.EQ.4) GO TO 1500
    L = L+2
    LS=LS+1
    IF (LS.EQ.1.AND.FLG17.GT.0) L=L-2
    DO 1400 I = 1, NT
        RB(I,L) = A(I)
1400 RB(I,L+1) = B(I)
1500 CONTINUE
1600 REWIND 4
    NSIG = NSIGC
    CALL CROSS
2000 IF (FLG21.LE.0) RETURN
    REWIND 4
    IF (FLG22.GT.0) GO TO 2400
    L = 0
C***    ***IF CONTROL REACHES THIS POINT, THERE IS AT LEAST 1 NNU
C***    ***SKIP RECORD WITH SIN AND COS
    READ (4)
    DO 2200 J = 1, NNU
        READ(4) MS, (A(I), I=1, NT), (B(I), I=1, NT)
        L = L + 1
        DO 2200 I = 1, NT
            RB(I,L) = A(I)
2200 RB(I,L+1) = B(I)
2400 REWIND 4
    NSIG = NSIGEC
C***    ***CALL TO EXCROS FOR GENERATED (RESEP) BOUNDARY CONDITIONS
    CALL EXCROS
    RETURN
    END

```

\$IBFTC AXIS DECK

```
C
C SUBROUTINE AXIS
C
C      * COMPUTE AXISYMMETRIC VELOCITY COMPONENTS AND PRINT
C
COMMON HEDR(10) ,CASE ,NB ,NNU
1 ,FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
2 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
3 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
4 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
5 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
1 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
2 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
3 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
4 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
COMMON NT ,NC(11) ,MN ,NUNA(4) ,TYPEA(4)
1 ,NER1 ,NER2 ,NMA ,NSIGA ,NSIGC
2 ,NUNC(4) ,TYPEC(4) ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /P/ IPUVEL
REAL MN

C
COMMON /C4/ X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1 SINA(500), COSA(500), XP(500), YP(500)
COMMON /TC/ RB(500,8), SIG(500,4), A(500), B(500), Z(500),
1 PHI(500,4), XN(500,4),
2 T(500,4), T3(500,4), NSIG, NP, NI, SUMV
3 ,SUMM(4)

C
DIMENSION VX(500,4), VY(500,4), VT(500,4), TH(500,4), CP(500,4),
1 SUMTDS(4)

C
EQUIVALENCE ( VX(1,1) , XN(1,1) ) , ( VY(1,1), T(1,1) ) ,
1 ( VT(1,1), T3(1,1) ), ( TH(1,1), SIG(1,1) ), ( CP(1,1), T3(1,1) )

C
EQUIVALENCE (VY,VYDP), (VT,VTDP), (T,TDP), (VX,VXDP)
DIMENSION TDP(1), VXDP(1), VYDP(1), VTDP(1)

C
* START
NC=NT
IF (FLG19.GT.0) NC=NMA
IF (FLG08.EQ.0) GO TO 10

C
* TITLE FOR MATRIX PRINT
WRITE (6,150) HEDR,CASE
WRITE (6,8)
8 FORMAT (1H 43H MATRICES A,B,Z BY ROWS * AXISYMMETRIC FLOW //)

C
* READ AXIS SIGMAS
10 DO 20 N=1,NSIG
SUMM(N)=0.0
```

```

      SUMTDS(N)=0.0
20  READ (3) (SIG(I,N),I=1,NC)
      IF (FLG19.LE.0) GO TO 25
      READ (4)
      NR = NMA+1
      READ (4) (SIG(I,1),I=NR,NT)
      REWIND 4
C      * NC. OF MIDPOINTS LCOP
25  GO 100 I=1,NT
C      * READ MATRICES A,B,Z
      READ (9) (A(J),J=1,NT),(B(J),J=1,NT),(Z(J),J=1,NT)
C      * NC. OF FLGS LCOP
      N1=0
      GO 70 N=1,NSIG
      N1=N1+2
      SN=0.0
      ST=0.0
      SP=0.0
C      * NC. OF ELEMENTS LCOP
      GO 30 J=1,NT
      SN=SN+A(J)*SIG(J,N)
      ST=ST+B(J)*SIG(J,N)
30  SP=SP+Z(J)*SIG(J,N)
      IF (FLG22.GT.0) GO TO 68
      IF (FLG12.EQ.0) GO TO 40
      XN(I,N)=SN
      PHI(I,N)=SP-RB(I,N1-1)
      GO TO 50
40  XN(I,N)=SN-RB(I,N1-1)
      PHI(I,N)=SP
50  IF (FLG11.EQ.0) GO TO 60
      T(I,N)=ST
      GO TO 65
60  T(I,N)=ST+RB(I,N1)
65  SUMM(N)=SUMM(N)+PHI(I,N)*Y2(I)*RB(I,N1-1)*DELS(I)
      CP(I,N)=1.-T(I,N)**2
      GO TO 70
68  XN(I,N) = SN
      PHI(I,N) = SP
      T(I,N) = ST
      CP(I,N) = 1.0 - T(I,N)**2
70  CCNTINUE
      IF (FLG08.EQ.0) GO TO 100
      WRITE (6,80) I,(A(J),J=1,NT)
80  FORMAT (1H0 13H MATRIX A ROW 16/ (1H 10F10.5))
      WRITE (6,85) I,(B(J),J=1,NT)
85  FORMAT (1H0 13H MATRIX B ROW 16/ (1H 10F10.5))
      WRITE (6,90) I,(Z(J),J=1,NT)
90  FORMAT (1H0 13H MATRIX Z ROW 16/ (1H 10F10.5))
100 CCNTINUE
      IF (MN.EQ.0.0) GO TO 130
C      * MACH NO. ADJUSTMENT
      C1=MN*MN
      C2=1.-C1
      C3=SQRT(C2)
      C4=.7*C1

```

```

C5=.2*D1
CC 120 N=1,NSIG
CC 120 I=1,NT
TX=(T(I,N)*CCSA(I)-1.)/D2+1.
TY = ( T(I,N) * SINA(I) ) / D3
T(I,N)=SQRT(TX*TX+TY*TY)
120 CP(I,N)=((1.+D5*(1.-T(I,N)**2))**3.5-1.)/D4
C      * ELIMINATE MACH NO EFFECT FOR PRINTOUT
CC 122 I=1,NI
122 X1(I)=X1(I)*D3
N=0
J1=0
CC 126 K=1,NB
M=N+1
N=N+ND(K)-1
CC 124 J=M,N
J1=J1+1
T1=X1(J1+1)-X1(J1)
T2=Y1(J1+1)-Y1(J1)
X2(J)=(X1(J1+1)+X1(J1))/2.
DELS(J)=SQRT(T1*T1+T2*T2)
CCSA(J)=T1/DELS(J)
124 SINA(J)=T2/DELS(J)
126 J1=J1+1
C      * PRINT AXIS FLOW (CN-BODY) OUTPUT
130 CC 250 L=1,NSIG
KA = L
IF (FLG16.LE.0) KA=L-1
IF (FLG22.GT.0) KA = L
IF(FLG22.GT.0)GO TO 136
SUMM(L)=-6.2831853*SUNM(L)
CC 135 J = 1, NT
135 SUMTDS(L) = SUMTDS(L) + T(J,L)*DELS(J)
136 I = 1
J=1
M=1
N=NC(M)
LCTR=22
140 WRITE (6,150) HEDR,CASE
150 FORMAT (1H1 25X, 26HCUGLAS AIRCRAFT COMPANY /
1      28X, 21HLCNG BEACH DIVISION ///
2      6X, 10A6, 4X, 10HCASE NO. A6 // )
IF (FLG22.GT.0) GO TO 178
IF (L.GT.1.CR.FLG16.NE.0) GO TO 170
WRITE (6,160)
160 FORMAT (1H 34H ON-BODY UNIFORM AXISYMMETRIC FLOW )
GO TO 190
170 IF (TYPEA(KA).GE.0.0) GO TO 175
WRITE (6,172)
172 FORMAT (1H 44H FLOW GENERATOR * ROTATING BODY * TYPE ERROR )
175 IF (NUNA(KA).EQ.123456) WRITE (6,177)
177 FORMAT (27H CN-BODY STRIP VORTEX FLOW)
178 IF (NUNA(KA).NE.123456) WRITE(6,180)NUNA(KA)
180 FORMAT (1H 42H CN-BODY NON-UNIFORM AXISYMMETRIC FLOW NO: 18)
190 WRITE (6,200)
200 FORMAT (1H 5X 24H TRANSFORMED COORDINATES //

```

```

1          12X 1HX 13X 1FY 13X          2HT1 12X 2HCP 9X 5HSIN A
2          6X 5HCOS A 7X 5HSIGMA 11X 1HN 13X 3HPHI //)
210 WRITE (6,220) I,X1(I),Y1(I),X2(J),Y2(J),      T(J,L),CP(J,L),
1          SINA(J),COSA(J),SIG(J,L),XN(J,L),PHI(J,L)
220 FORMAT (1H 13,2F14.7/ 4X 4F14.7,2F11.5,3F14.7)
      I=I+1
      J=J+1
      IF (I.EQ.N) GO TO 230
      IF (I.LE.LCTR) GO TO 210
      LCTR=LCTR+22
      GO TO 140
230 M=M+1
      N=N+ND(M)
      WRITE (6,240) I,X1(I),Y1(I)
240 FORMAT (1H 13, 2F14.7 //)
      I=I+1
      IF ( J - NT ) 210, 242, 242
242 IF (FLG22.GT.0) GO TO 250
      WRITE(6,244) SUMM(L), SUMV, SUMTDS(L)
244 FORMAT (1HC 1GX 13H ACCED MASS =F12.7, 4X 9H VOLUME = F12.7,
A          5X 18HSUM (T)(DELTA S) = F12.7 )
250 CONTINUE
      CALL BCDUMP(X2(1),X2(NT))
      CALL BCDUMP(Y2(1),Y2(NT))
      CALL BCDUMP(TCP(1),TIP(NT))
      IF (IPUVEL .EQ. 0) GC TO 252
      LCC = 100
      CALL PUNCHC (X2, NT, LCC, CASE )
      LCC = 500
      CALL PUNCHC ( Y2, NT, LOC, CASE )
      LCC = 900
      CALL PUNCHV ( T, NT, NSIG, LCC, CASE )
252 IF (FLG05.EQ.0) RETURN
C          * OFF-BODY PCINT
      IF (FLG15.LE.0) GO TO 258
      M = 0
      DO 254 I = 1, NB
254 IF (NLF(I) .LE. 0) M = M + 1
      IF ( M .EQ. 0 ) GC TO 258
      MM = NNU + 1
      DO 255 I = 1, MM
255 READ (4)
      IF (FLG22.GT.0)READ(4)
      DO 256 J = 1, M
256 READ(4) (RB(I,J),I = 1,NP), (T3(I,J),I = 1,NP)
      REWIND 4
258 DO 300 I = 1, NP
      L=0
C          * READ MATRICES X,Y,Z
      READ (9) (A(J),J=1,NT),(B(J),J=1,NT),(Z(J),J=1,NT)
C          * NO. OF FLGW
      DO 300 N=1,NSIG
      KA=N
      IF (FLG16.LE.0) KA=N-1
      SX=0.0
      SY=0.0

```



```

      SP=0.0
C      * NO. OF ELEMENTS LOOP
      DO 260 J=1,NT
      SX=SX+A(J)*SIG(J,N)
      SY=SY+B(J)*SIG(J,N)
260    SP=SP+Z(J)*SIG(J,N)
      PHI(I,N)=SP
      IF (FLG22.GT.0) GO TO 270
      IF (FLG11.GT.0) GO TO 270
      IF (N.NE.1.OR.FLG16.GT.0) GO TO 262
      VX(I,N) = SX+1.
      GO TO 280
262    IF (NUNA(KA).NE.123456) GO TO 270
      L=L+1
      VX(I,N)=SX+RB(I,L)
      VY(I,N)=SY+T3(I,L)
      GO TO 300
270    VX(I,N) = SX
280    VY(I,N) = SY
300    CONTINUE
      IF (MN.EQ.0.0) GO TO 330
C      * MACH NO. ADJUSTMENT
      DO 320 N=1,NSIG
      DO 320 I=1,NP
      VY(I,N)=VY(I,N)/D3
320    VX(I,N)=(VX(I,N)-1.)/C2+1.
      DO 322 I = 1, NP
322    XP(I)=XP(I)*D3
C      * COMPUTE VT AND THETA
330    DO 335 N=1,NSIG
      DO 335 I=1,NP
      VT(I,N)=SQRT(VX(I,N)**2+VY(I,N)**2)
335    TH(I,N)=ATAN2(VY(I,N),VX(I,N)) * 57.29578
C      * PRINT AXIS FLOW (OFF-BODY) OUTPUT
      DO 450 L=1,NSIG
      KA = L
      IF(FLG16.LE.0.AND.FLG22.LE.0) KA = L - 1
      I=1
      LCTR=45
340    WRITE (6,150) HEDR,CASE
      IF (L.GT.1.OR.FLG16.NE.0) GO TO 370
      IF(FLG22.GT.0) GO TO 378
      WRITE (6,360)
360    FORMAT (1H 35H OFF-BODY UNIFORM AXISYMMETRIC FLOW )
      GO TO 390
370    IF (TYPEA(KA).GE.0.) GO TO 375
      WRITE (6,172)
375    IF (NUNA(KA).EQ.123456) WRITE (6,377)
377    FORMAT (28H OFF-BODY STRIP VORTEX FLOW)
378    IF (NUNA(KA).NE.123456) WRITE (6,380) NUNA(KA)
380    FORMAT (1H 43H OFF-BODY NON-UNIFORM AXISYMMETRIC FLOW NO. 18)
390    WRITE (6,400)
400    FORMAT (1H 5X, 24H TRANSFORMED COORDINATES //
      1      12X 1HX 13X 1FY 13X      2HVN 12X 2HVN 12X 2HVN 10X
      2      5HTheta 11X 3PHI //)
410    WRITE (6,420) I,XP(I),YP(I),      VX(I,L),VY(I,L),VT(I,L),

```

```

      I TH(I,L), PHI(I,L)
420  FORMAT (1H I3, 7F14.7)
      I=I+1
      IF (I.GT.NP) GO TO 450
      IF (I.LE.LCTR) GO TO 410
      LCTR=LCTR+45
      GO TO 340
450  CONTINUE
      CALL BCDUMP(XP(1),XP(NP))
      CALL BCDUMP(YP(1),YP(NP))
      CALL BCDUMP(VXDP(1),VXDP(NP))
      CALL BCDUMP(VYDP(1),VYDP(NP))
      CALL BCDUMP(VTDP(1),VTDP(NP))
500  IF (IPUVEL .EQ. 0) RETURN
      LOC = 2500
      CALL PUNCHC ( XP, NP, LOC, CASE )
      LOC = 2900
      CALL PUNCHC ( YP, NP, LOC, CASE )
      LOC = 3300
      CALL PUNCHV ( VX, NP, NSIG, LOC, CASE )
      LOC = 4900
      CALL PUNCHV ( VY, NP, NSIG, LOC, CASE )
      RETURN
      END

```

\$IBFTC CROSS DECK

SUBROUTINE CROSS

C  
C  
C

\* COMPUTE CROSS FLOW VELOCITY COMPONENTS AND PRINT

```

COMMON      HEDR(10) ,CASE      ,NB      ,NNU
1           ,FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
2           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
3           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
4           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
5           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER      FLG03      ,FLG04      ,FLG05      ,FLG06      ,FLG07
1           ,FLG08      ,FLG09      ,FLG10      ,FLG11      ,FLG12
2           ,FLG13      ,FLG14      ,FLG15      ,FLG16      ,FLG17
3           ,FLG18      ,FLG19      ,FLG20      ,FLG21      ,FLG22
4           ,FLG23      ,FLG24      ,FLG25      ,FLG26      ,FLG27
COMMON      NT      ,ND(11)      ,MN      ,NUNA(4)      ,TYPEA(4)
1           ,NER1      ,NER2      ,NMA      ,NSIGA      ,NSIGC
2           ,NUNC(4)      ,TYPEC(4)      ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /P/ IPUVEL
REAL      MN

```

C

```

COMMON /C4/ X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1           SINA(500), COSA(500), XP(500), YP(500)
COMMON /TC/ RB(500,8), SIG(500,4), A(500), B(500), Z(500),
1           PHI(500,4), XN(500,4),
2           T(500,4), T3(500,4), NSIG, NP, NI, SUMV
3           ,SUMM(4)

```

C

DIMENSION VX(500,4), VY(500,4), VZ(500,4), T2(500,4)

C

```

EQUIVALENCE ( VX(1,1), XN(1,1) ), ( VY(1,1), T(1,1) ),
1 ( VZ(1,1), T3(1,1) ), ( T2(1,1), T(1,1) )

```

C

```

EQUIVALENCE (VZ,VZDP),(VX,VXDP),(VY,VYDP),(T2,T2DP),(T3,T3DP)
DIMENSION T2DP(1), T3DP(1), VXDP(1), VYDP(1), VZDP(1)

```

C

\* START

IF (FLG08.EQ.0) GO TO 10

C

\* TITLE FOR MATRIX PRINT

WRITE (6,150) HEDR,CASE

WRITE (6,8)

8 FORMAT (1H 36H MATRICES A,B,Z BY ROWS \* CROSS FLOW //)

C

\* READ CROSS SIGMAS

10 DO 20 N=1,NSIG

SUMM(N)=0.0

20 READ (3) (SIG(I,N),I=1,NT)

C

\* NO. OF MIDPOINTS LOOP

DO 100 I=1,NT

C

\* READ MATRICES A,B,Z

```

      READ (10) (A(J),J=1,NT),(B(J),J=1,NT),(Z(J),J=1,NT)
C      * NO. OF FLOWS LOOP
      M=0
      DO 70 N=1,NSIG
      M=M+2
      SA=0.0
      SB=0.0
      SZ=C.0
C      * NO. OF ELEMENTS LOOP
      DO 30 J=1,NT
      SA=SA+A(J)*SIG(J,N)
      SB=SB+B(J)*SIG(J,N)
30    SZ=SZ+Z(J)*SIG(J,N)
C      * INITIALIZE UNIFORM OR NON-UNIFORM PARAMETERS
      IF (FLG21.GT.0) GO TO 38
      IF (N.EQ.1.AND.FLG17.LE.0) GO TO 35
      C1=RB(I,M)
      C2 = -RB(I,M-1)
      C3=0.0
      GO TO 40
35    C1=SINA(I)
      C2=COSA(I)
      C3=1.
      GO TO 40
38    C1 = 0.0
      C2 = 0.0
      C3 = 0.0
40    IF (FLG12.EQ.0) GO TO 45
C      * OPTION FOR Z (PHI) MATRIX SOLUTION
      XN(I,N) = SA
      PHI(I,N) = Y2(I) * SZ
      GO TO 50
C      * REGULAR A MATRIX SOLUTION
45    PHI(I,N)=Y2(I)*SZ
      XN(I,N)=SA+C2
50    IF (FLG11.EQ.0) GO TO 55
C      * OPTION PERTURBATIONS
      T2(I,N)=SB
      T3(I,N)=SZ
      GO TO 60
55    T2(I,N)=SB+C1
      T3(I,N)=SZ+C3
60    IF(FLG21.GT.0) GO TO 70
      SUMM(N) = SUMM(N) + PHI(I,N) * Y2(I) * C2 * DELS(I)
70    CONTINUE
      IF (FLG08.EQ.0) GO TO 100
      WRITE (6,80) I,(A(J),J=1,NT)
80    FORMAT (1H0 13H MATRIX A ROW 16/ (1H 10F10.5))
      WRITE (6,85) I,(B(J),J=1,NT)
85    FORMAT (1H0 13H MATRIX B ROW 16/ (1H 10F10.5))
      WRITE (6,90) I,(Z(J),J=1,NT)
90    FORMAT (1H0 13H MATRIX Z ROW 16/ (1H 10F10.5))
100   CONTINUE
C      * PRINT CROSS FLOW (ON-BODY) OUTPUT
130   DO 250 L=1,NSIG
      KC = L

```

```

      IF (FLG17.LE.0) KC=L-1
      IF (FLG21.GT.0) GO TO 138
      SUMM(L) = 3.141593 *SUMM(L)
138  I = 1
      J=1
      M=1
      N=ND(M)
      LCTR=22
140  WRITE (6,150) HEDR,CASE
150  FORMAT (1H1 25X, 26HCCUGLAS AIRCRAFT COMPANY /
      1      28X, 21HLCNG REACH DIVISION ///
      2      6X, 10A6, 4X, 10FCASE NO. A6 ///)
      IF (FLG22.GT.0) GO TO 175
      IF (L.GT.1.OR.FLG17.NE.0) GO TO 170
      WRITE (6,160)
160  FORMAT (1H 27H ON-BODY UNIFORM CROSS FLOW )
      GO TO 190
170  IF (TYPEC(KC).GE.0.) GO TO 175
      WRITE (6,172)
172  FORMAT (1H 31H FLCW GENERATOR * ROTATING BODY )
175  WRITE (6,180) NUNC(KC)
180  FORMAT (1H 35H ON-BODY NON-UNIFORM CROSS FLOW NO. 18)
190  WRITE (6,200)
200  FORMAT (1H 5X 24H TRANSFORMED COORDINATES //
      1      12X 1HX 13X 1FY 13X      2HT2 12X 2HT3 9X 5HSIN A
      2      6X 5HCOS A 7X 5HSIGMA 11X 1HN 13X 3HPHI ///)
210  WRITE (6,220) I,X1(I),Y1(I),X2(J),Y2(J),      T2(J,L),T3(J,L),
      1      SINA(J),COSA(J),SIG(J,L),XN(J,L),PHI(J,L)
220  FORMAT (1H I3,2F14.7/ 4X 4F14.7,2F11.5,3F14.7)
      I=I+1
      J=J+1
      IF (I.EQ.N) GO TO 230
      IF (I.LE.LCTR) GO TO 210
      LCTR=LCTR+22
      GO TO 140
230  M=M+1
      N=N+ND(M)
      WRITE (6,240) I,X1(I),Y1(I)
240  FORMAT (1H I3, 2F14.7 ///)
      I=I+1
      IF (J.GT.NT) GO TO 242
      GO TO 210
242  IF (FLG22.GT.0) GO TO 250
      WRITE(6,244) SUMM(L), SUMV
244  FORMAT (1H0 10X,14H ACCED MASS = F12.7, 4X,10H VOLUME = F12.7)
250  CONTINUE
      CALL BCDUMP(X2(1),X2(NT))
      CALL BCDUMP(Y2(1),Y2(NT))
      CALL BCDUMP(T2DP(1),T2CP(NT))
      CALL BCDUMP(T3DP(1),T3CP(NT))
      IF (IPUVEL .EQ. 0) GO TO 252
      LCC = 6500
      CALL PUNCHV ( T2, NT, NSIG, LOC, CASE )
      LCC = 6900
      CALL PUNCHV (T3, NT, NSIG, LCC, CASE )
252  IF (FLG05.EQ.0) RETURN

```

```

C          * OFF-BODY PCINT
CO 300 I=1,NP
C          * READ MATRICES X,Y,Z
READ (10) (A(J),J=1,NT),(B(J),J=1,NT),(Z(J),J=1,NT)
C          * NO. OF FLCH
CO 300 N=1,NSIG
SX=0.0
SY=0.0
SP=0.0
C          * NO. OF ELEMENTS LCOP
CO 260 J=1,NT
SX=SX+A(J)*SIG(J,N)
SY=SY+B(J)*SIG(J,N)
260 SP=SP+Z(J)*SIG(J,N)
VX(I,N)=SX
PHI(I,N)=YP(I)*SP
IF (FLG22.GT.0) GO TO 270
IF (FLG11.GT.0.OR.N.AE.1.OR.FLG17.GT.0) GO TO 270
VY(I,N)=SY+1.
VZ(I,N)=SP+1.
GO TO 300
C          * PERTURBATION CR NON-UNIFORM VY,VZ
270 VY(I,N)=SY
VZ(I,N)=SP
300 CCNTINUE
C          * PRINT CROSS FLOW (OFF-BODY) OUTPUT
330 CO 450 L=1,NSIG
KC = L
IF (FLG17.LE.0) KC=L-1
I=1
LCTR=45
340 WRITE (6,150) HEDR,CASE
IF (FLG22.GT.0) GO TO 375
IF (L.GT.1.OR.FLG17.NE.0) GO TO 370
WRITE (6,360)
360 FORMAT (1H 28H OFF-BODY UNIFORM CROSS FLOW )
GO TO 390
370 IF (TYPEC(KC).GE.0.) GO TO 375
WRITE (6,172)
375 WRITE (6,380) NUNC(KC)
380 FORMAT (1H 36H OFF-BODY NON-UNIFORM CROSS FLOW NO. 18)
390 WRITE (6,400)
400 FORMAT (1H 5X, 24H TRANSFORMED COORDINATES //
1 12X 1HX 13X 1HY 13X 2HVX 12X 2HVV 12X 2HVZ 12X 3HPHI //)
410 WRITE (6,420) I,XP(I),YP(I),VX(I,L),VY(I,L),VZ(I,L),PHI(I,L)
420 FORMAT (1H 13, 6F14.7)
I=I+1
IF (I.GT.NP) GO TO 450
IF (I.LE.LCTR) GO TO 410
LCTR=LCTR+45
GO TO 340
450 CCNTINUE
CALL BCDUMP(XP(1),XP(NP))
CALL BCDUMP(YP(1),YP(NP))
CALL BCDUMP(VXDP(1),VXDP(NP))
CALL BCDUMP(VYDP(1),VYDP(NP))
CALL BCDUMP(VZDP(1),VZDP(NP))
500 IF (IPUVEL.EQ.0) RETURN
LCC = 7300
CALL PUNCHV ( VX, NP, NSIG, LOC, CASE )
LCC = 7700
CALL PUNCHV ( VY, NP, NSIG, LOC, CASE )
LCC = 8100
CALL PUNCHV(VZ,NP,NSIG,LOC,CASE)
RETURN
END

```

\$IBFTC EXCR DECK

```

SUBROUTINE EXCROS
C***  ***COMPUTE EXTRA CROSS FLOW VELOCITY COMPONENTS AND PRINT
COMMON HEDR(10) ,CASE ,NB ,NNU
1 ,FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
2 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
3 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
4 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
5 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
DOUBLE PRECISION HEDR, CASE
INTEGER FLG03 ,FLG04 ,FLG05 ,FLG06 ,FLG07
1 ,FLG08 ,FLG09 ,FLG10 ,FLG11 ,FLG12
2 ,FLG13 ,FLG14 ,FLG15 ,FLG16 ,FLG17
3 ,FLG18 ,FLG19 ,FLG20 ,FLG21 ,FLG22
4 ,FLG23 ,FLG24 ,FLG25 ,FLG26 ,FLG27
COMMON NT ,NE(11) ,MN ,NUNA(4) ,TYPEA(4)
1 ,NER1 ,NER2 ,NMA ,NSIGA ,NSIGC
2 ,NUNC(4) ,TYPEC(4) ,NLF(11)
COMMON IEC, NSIGEC, TYPEEC(4), NUNEC(4)
COMMON /P/ IPUVEL
REAL MN

C
COMMON /C4/ X1(500), Y1(500), X2(500), Y2(500), DELS(500),
1 SINA(500), COSA(500), XP(500), YP(500)
COMMON /TC/ RB(500,8), SIG(500,4), A(500), B(500), Z(500),
1 PHI(500,4), XN(500,4),
2 T(500,4), T3(500,4), NSIG, NP, NI, SUMV
3 ,SUMM(4)

C
DIMENSION VX(500,4), VY(500,4), VZ(500,4), T2(500,4)

C
EQUIVALENCE ( VX(1,1), XN(1,1) ), ( VY(1,1), T(1,1) ),
1 ( VZ(1,1), T3(1,1) ), ( T2(1,1), T(1,1) )

C
REWIND 8
IF (FLG08.EQ.0) GO TO 10
C***  ***TITLE FOR MATRIX PRINT
WRITE (6,150) HEDR,CASE
WRITE (6,8)
8 FORMAT (1H 42H MATRICES A,B,Z BY ROWS * EXTRA CROSS FLOW //)
C***  ***READ EXTRA CROSS SIGMAS
10 DO 20 N = 1, NSIG
20 READ (3) ( SIG(I,N), I = 1, NT )
C***  ***NO. OF MIDPOINTS LCOP
DO 100 I = 1, NT
C***  ***READ MATRICES A,B,Z
C***  ***YOU MUST SOLVE POTENTIAL MATRIX FOR EXCROS
READ (8) ( A(J), J = 1, NT ), ( B(J), J = 1, NT ), ( Z(J), J = 1, NT )
C***  ***NO. OF FLOWS LOOP
N = 0
DO 70 N = 1, NSIG

```

///

```

      M = M + 2
      SA = 0.0
      SB = 0.0
      SZ = 0.0
C***      ***NO. OF ELEMENTS LCCP
      DO 30 J = 1,NT
      SA = SA + A(J) * SIG(J,N)
      SB = SB + B(J) * SIG(J,N)
30      SZ = SZ + Z(J) * SIG(J,N)
40      T2(I,N) = SB
      T3(I,N) = SZ
      XN(I,N) = SA
      PHI(I,N) = Y2(I) * SZ / 2.0
70      CONTINUE
      IF (FLG08.EQ.0) GO TO 100
      WRITE (6,80) I, (A(J),J = 1,NT)
80      FORMAT (1H0 13H MATRIX A ROW I6/ (1H 10F10.5) )
      WRITE (6,85) I, (B(J),J = 1,NT)
85      FORMAT (1H0 13H MATRIX B ROW I6/ (1H 10F10.5) )
      WRITE (6,90) I, (Z(J),J = 1,NT)
90      FORMAT (1H0 13H MATRIX Z ROW I6/ (1H 10F10.5) )
100     CONTINUE
C***      ***PRINT EXTRA CROSS FLOW (CN BODY) OUTPUT
130     DO 250 L = 1,NSIG
      KEC = L
      I = 1
      J = 1
      M = 1
      N = ND(M)
C***      ***M IS THE BODY NUMBER
C***      ***N IS THE NUMBER OF POINTS ON BODY M
      LCTR = 22
140     WRITE (6,150) HEDR,CASE
150     FORMAT (1H1 25X, 26HDCUGLAS AIRCRAFT COMPANY /
1      28X, 21HLONG BEACH DIVISION ///
2      6X, 10A6, 4X, 10HCASE NO. A6 ///)
      IF (FLG22.GT.0) GO TO 160
      WRITE (6,155)NUNEC(KEC)
155     FORMAT(41H CN-BODY NON-UNIFORM EXTRA CROSS FLOW NO. I8)
      GO TO 190
160     WRITE (6,162)
162     FORMAT(68H ON BODY GENERATED (RESEP) BOUNDARY CONDITIONS EXTR
1A CROSS FLOW)
190     WRITE (6,200)
200     FORMAT (1H 5X 24H TRANSFORMED COORDINATES //
1      12X 1HX 13X 1HY 13X 2HT2 12X 2HT3 9X 5HSIN A
2      6X 5HCOS A 7X 5HSIGMA 11X 1HN 13X 3HPHI //)
210     WRITE (6,220) I,X1(I),Y1(I),X2(J),Y2(J), T2(J,L),T3(J,L),
1      SINA(J),CCSA(J),SIG(J,L),XN(J,L),PHI(J,L)
220     FORMAT (1H 13,2F14.7/ 4X 4F14.7,2F11.5,3F14.7)
      I = I + 1
      J = J + 1
      IF (I.EQ.N) GO TO 230
      IF (I.LE.LCTR) GO TO 210
      LCTR = LCTR + 22
      GO TO 140

```



```

230 M = M + 1
    N = N + ND(M)
    WRITE (6,240) I , X1(I), Y1(I)
240 FORMAT (1H I3,2F14.7 //)
    I = I + 1
    IF (J.GE.NT) GO TO 250
    GO TO 210
250 CONTINUE
C***   ***THIS IS WHERE THE CALL FOR PUNCHED OUTPUT WILL GO
252 IF (FLG05.EQ.0) RETURN
C***   ***OFF BODY POINTS
    DO 300 I = 1,NP
C***   ***READ MATRICES X,Y,Z
    READ (8) ( A(J),J=1,NT ),(B(J),J = 1,NT), ( Z(J),J = 1,NT )
    DO 300 N = 1,NSIG
    SX = 0.0
    SY = 0.0
    SP = 0.0
C***   ***NUMBER OF ELEMENTS LCOP
    DO 260 J = 1,NT
    SX = SX + A(J) * SIG (J,N)
    SY = SY + B(J) * SIG (J,N)
260 SP = SP + Z(J) * SIG(J,N)
    VX(I,N) = SX
    VY(I,N) = SY
    VZ(I,N) = SP
    PHI(I,N) = YP(I) * SP / 2.0
300 CONTINUE
C***   ***PRINT EXTRA CROSS FLOW (OFF-BODY) OUTPUT
330 DO 450 L = 1,NSIG
    KEC = L
    I = 1
    LCTR = 45
340 WRITE (6,150) HEDR,CASE
    IF (FLG22.GT.0) GO TO 355
    WRITE(6,350) NUNEC(KEC)
350 FORMAT (43H OFF BODY NON-UNIFORM EXTRA CROSS FLOW NO. I8)
    GO TO 390
355 WRITE(6,357)
357 FORMAT(68H OFF BODY GENERATED (RESEP) BOUNDARY CONDITIONS EXTR
1A CROSS FLOW)
390 WRITE (6,400)
400 FORMAT (1H 5X, 24H TRANSFORMED COORDINATES //
1 12X 1HX 13X 1HY 13X 2HVX 12X 2HVV 12X 2HVZ 12X 3HPHI //)
410 WRITE (6,420) I,XP(I),YP(I),VX(I,L),VY(I,L),VZ(I,L),PHI(I,L)
420 FORMAT (1H I3, 6F14.7)
    I = I + 1
    IF (I.GT.NP)GO TO 450
    IF (I.LE.LCTR) GO TO 410
    LCTR = LCTR + 45
    GO TO 340
450 CONTINUE
C***   ***THIS IS WHERE THE CALL TO PUNCHED OUTPUT OFF BODY WILL GO
    RETURN
    END

```

## 435

C THE MAIN PROGRAM FOR APPROACH 5 COMBYN

C

1 ,MO,JA,IR,NRUNNO,MD2,JA2,IR2,NRUNO2

2

## CALL" READS

VSAVE=VINF

```
IF (VINFL.EQ.0.0) GO TO 4
```

```
VINF=VINF*(1.0-.2*(VINF/ATOTAL)**2)**2.5
```

4

VCSAVE=VC

$$V_C = V_{IC}$$

CALL GETABC

VC=VCSAVE

**VINFP=VINFP**

VINF=VSAVE

```
WRITE (6,8) VMAG(1),VMAG(2),ALIL,BLIL,CLIL,VINFP
```

**CALL AVERY**

REWIND 2

REWIND 3

DO 6 N=1,NTHETA

WRITE (6,10) N,NTHETA

READ (3) WDOOT, VICT

```
WRITE (6,12) THETA(N),WDOTT,VICT,VMAG(3)
```

$$\text{THETA}(N) = \text{THETA}(N) * \text{PI}0180$$

**SINTH=SIN(THETA(N))**

$$C \sin \theta = CLIL * \sin \theta$$

COSTH=COS( THETA(N) )

$$CCOSTH = CLIL * COSTH$$

OMEGA=UTIP/YRISHR

**CALL ONOFF**

6

**CONTINUE**

**GO TO 2**

**C\*\*\*\*\***

### C\*\*\* FORMATS

C\*\*\*\*\*

C

8           FORMAT (97H                 V1                                 V2                                 A  
            1 B                         C                 VINFP                 /5X,1P6E14.3)

10 FORMAT (1H0,4X,12,4H OF ,12,7H THETAS/1H0)

```
12  FORMAT (3X,8MTHETA = ,E12.5,13H      WDOTT = ,1PE12.5,12H      VICT
1   1= ,1PE12.5,10H      V3 = ,1PE12.5)
      END
```

\$IBFTC SINTP.

```

SUBROUTINE SINTP (Z,W,N,X1,Y1)
DIMENSION X(200), Y(200), Z(1), W(1)
DO 2 I=1,N
  X(I)=Z(I)
  Y(I)=W(I)
  CALL SORTXY (X,Y,N)
C
DO 4 I=1,N
  K=I
  IF (X1.GT.X(I)) GO TO 4
  IF (X1.EQ.X(I)) GO TO 6
  IF (X1.LT.X(I)) GO TO 8
  4 CONTINUE
  6 Y1=Y(K)
  GO TO 10
  8 IF (K.EQ.1) GO TO 12
  IF (K.EQ.N) K=N-1
  IF (X(K).EQ.X(K+1)) K=K-1
  W1=(X1-X(K))*(X1-X(K+1))/(X(K-1)-X(K))/(X(K-1)-X(K+1))
  W2=(X1-X(K-1))*(X1-X(K+1))/(X(K)-X(K-1))/(X(K)-X(K+1))
  W3=(X1-X(K-1))*(X1-X(K))/(X(K+1)-X(K-1))/(X(K+1)-X(K))
  Y1=Y(K-1)*W1+Y(K)*W2+Y(K+1)*W3
  10 RETURN
  12 Y1=0.0
  RETURN
END
```

\$IBFTC INTPL. DEBUG,DECK

```
      SUBROUTINE INTPOL (L,J,XI,IFLAG,VX,VRES,BETA,ALPH)
C*****
C*** THIS SUBROUTINE INTERPOLATES AND DIFFERENTIATES
C*****
      COMMON /CNOUT/ VRESON(400),VP(400),BETAON(400)
      COMMON /GEABC/ YI
      COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM,
1IN,NSPLT,YWING
      COMMON /RDOUT2/ T(400,2),VYAX(200,2),VYCR(200),V2(400),V3(400),VZC
1R(200)
      DIMENSION V(400), B(400)
      EPS=1.0E-6
      M=J-1
      N=J+1
      A=1.0
      DO 2 K=M,N
      XDIF=XI-XON(K)
      IF (XDIF.EQ.0.0) XDIF=EPS
      A=A*XDIF
2      CONTINUE
C
C      IF THE REAKE X EQUALS THE ON BODY X THEN SET INTERPOLATED VALUES
C      TO THE VALUES ON BODY
C
      IF (ABS(XI-XON(J)).LE.1.0E-6) GO TO 20
      DO 4 K=M,N
      B(K)=1.0
      DO 4 LL=M,N
      IF (LL.EQ.K) GO TO 4
      B(K)=B(K)*(XON(K)-XON(LL))
4      CONTINUE
      YI=0.0
      DUM=0.0
      VINT=0.0
      DO 12 II=M,N
      XDIF=XI-XON(II)
      IF (XDIF.EQ.0.0) XDIF=EPS
      IF (L.EQ.3) GO TO 6
      IF (IFLAG.GT.1) GO TO 8
      V(II)=T(II,L)
      GO TO 10
6      V(II)=V2(II)
      GO TO 10
8      V(II)=VRESON(II)
10     YI=YI+(A*YON(II))/(XDIF*B(II))
      VINT=VINT+(A*V(II))/(XDIF*B(II))
      IF (IFLAG.EQ.1) GO TO 12
      V(II)=VP(II)
      DUM=DUM+(A*V(II))/(XDIF*B(II))
12     CONTINUE
```

```

      IF (IFLAG.EQ.1) GO TO 16
      BETA=0.0
      PSOP=0.0
      DO 14 II=M,N
      XDIF=XI-XON(II)
      IF (XDIF.EQ.0.0) XDIF=EPS
      BETA=BETA+(A*BETAON(II))/(XDIF*B(II))
14    CONTINUE
16    JK=J
18    AD=XI-XON(JK-1)
      BD=XON(JK)-XI
      PO=AD*(AD+BD)
      P1=-(AD*BD)
      P2=(AD+BD)*BD
      A0=-BD
      A1=AD-BD
      A2=AD
      DY=(A0*YON(JK-1))/PO+(A1*YI)/P1+(A2*YON(JK))/P2
      ALPHA=ATAN(DY)
      ALPH=ALPHA/(3.14159265/180.)
      VX=VINT*COS(ALPHA)
      VRES=VINT
      IF (IFLAG.EQ.2) VX=DUM*COS(ALPHA)
      RETURN
20    IF (L.EQ.3) VINT=V2(J)
      VINT=T(J,L)
      IF (IFLAG.GT.1) VINT=VRESON(J)
      YI=YON(J)
      IF (IFLAG.NE.1) DUM=VP(J)
      BETA=BETAON(J)
      JK=J-1
      GO TO 18
      END

```

\$IBFTC GTABC. DEBUG,DECK

SUBROUTINE GETABC

C\*\*\*\*\*

C\*\*\* COMPUTES V1 , V2 , V3 , A , B , C FROM INPUT PARAMETERS  
COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM  
1IN,NSPLT,YWING  
COMMON /RDOUT2/ T(400,2),VYAX(200,2),VYCR(200),V2(400),V3(400),VZC  
1R(200)  
COMMON /NIN/ XOFF(200),YOFF(200),NPHIN,NCLO,NCHI  
COMMON /RDOUT3/ VXAX(200,2),VXCR(200)  
COMMON /RCONT1/ VC,VINF,ALFAF,TTOTAL,ELND,VA,PT  
COMMON /GETOUT/ VMAG(3),ALIL,BLIL,CLIL  
COMMON /GEABC/ YI  
DIMENSION VXAXH(2), VXAXS(2)  
PIO180=3.14159265/180.  
ALFAF=ALFAF\*PIO180  
DEBUG((VXAX(I,J),I=1,200),J=1,2)  
DEBUG(VXCR(I),I=1,200)

C\*\*\*\*\*

C\*\*\* COMPUTE V1 , V2 , V3

C\*\*\*\*\*

IF (XOFF(NCLO).LT.XON(1)) GO TO 6

C

C SEARCH ON HUB COUNTING BACKWARDS

C

J=NHUBMX

2 IF (XON(J).LT.XOFF(NCLO)) GO TO 4

J=J-1

GO TO 2

4

J=J+1

XH=XOFF(NCLO)

IFLAG=1

CALL INTPOL (1,J,XH,IFLAG,VX,DUM,DUM,DUM)

VXAXH(1)=VX

CALL INTPOL (2,J,XH,IFLAG,VX,DUM,DUM,DUM)

VXAXH(2)=VX

CALL INTPOL (3,J,XH,IFLAG,VXCRH,DUM,DUM,DUM)

YH=YI

GO TO 8

6

YH=0.0

VXAXH(1)=0.0

VXAXH(2)=0.0

VXCRH=0.0

C\*\*\*\*\*

C\*\*\* SEARCH ON SHROUD COUNTING FORWARDS

C\*\*\*\*\*

8

K=NHUBMX+1

10

IF (XON(K).LT.XOFF(NCHI)) GO TO 12

K=K+1

GO TO 10

12

K=K-1

```

XS=XOFF(NCHI)
IFLAG=1
CALL INTPOL (1,K,XS,IFLAG,VX,DUM,DUM,DUM)
VXAXS(1)=VX
CALL INTPOL (2,K,XS,IFLAG,VX,DUM,DUM,DUM)
VXAXS(2)=VX
CALL INTPOL (3,K,XS,IFLAG,VXCRS,DUM,DUM,DUM)
YS=YI
ILOW=NCLO+1
IHIGH=NCHI-1

```

```

C
C
C  AXIAL COMPONENT VELOCITY *** AXISSYMETRIC SOLUTION

```

```

DO 16 L=1,2
SUM=YH*VXAXH(L)*(YOFF(NCLO)-YH)+VXAX(NCLO,L)*YOFF(NCLO)*(YOFF(NCLO
1+1)-YH)
DO 14 I=ILOW,IHIGH
SUM=SUM+VXAX(I,L)*YOFF(I)*(YOFF(I+1)-YOFF(I-1))
14 CONTINUE
SUM=SUM+YOFF(NCHI)*VXAX(NCHI,L)*(YS-YOFF(NCHI-1))+(-1.0)*YS*VXAXS(
1L)*(YS-YOFF(NCHI))
VMAG(L)=SUM/(YS**2-YH**2)
16 CONTINUE

```

```

C
C
C  AXIAL COMPONENT CROSSFLOW VELOCITY SOLUTION

```

```

SUM=YH*VXCRH*(YOFF(NCLO)-YH)+VXCR(NCLO)*YOFF(NCLO)*(YOFF(NCLO+1)-Y
1H)
DO 18 I=ILOW,IHIGH
SUM=SUM+VXCR(I)*YOFF(I)*(YOFF(I+1)-YOFF(I-1))
18 CONTINUE
SUM=SUM+YOFF(NCHI)*VXCR(NCHI)*(YS-YOFF(NCHI-1))+(-1.0)*YS*VXCRS*(Y
1S-YOFF(NCHI))
VMAG(3)=SUM/(YS**2-YH**2)
CLIL=VINF*COS(ALFAF)
ALIL=(VC+VINF*SIN(ALFAF)*VMAG(2))/(VMAG(1)-VMAG(2))
BLIL=(VC+VINF*SIN(ALFAF)*VMAG(1))/(VMAG(2)-VMAG(1))
ALFAF=ALFAF/PI0180
RETURN
END

```

\$IBFTC VBART DECK

C APPROACH 5

C SUBROUTINE VBARIT (VBAR, ATOTAL, RHOTOT, RHOBAR)

C TO SOLVE VBAR COMP ITERATIVELY

C VCRIT=ATOTAL/SQRT(1.2)

I=0

VGUES=VBAR

2 VGUESA=(VGUES/ATOTAL)\*\*2

A=1.0-.2\*VGUESA

B=A-VGUESA

VCOMP=(VBAR-A\*\*2.5\*VGUES)/(A\*\*1.5\*B)+VGUES

IF (ABS((VCOMP-VGUES)/VCOMP).LT..0001) GO TO 4

I=I+1

IF (VCOMP.GE.VCRIT) VCOMP=.5\*(VGUES+VCRIT)

VGUES=VCOMP

IF (I.GT.20) GO TO 4

GO TO 2

4 RHOBAR=(1.0-.2\*(VCOMP/ATOTAL)\*\*2)\*\*2.5\*RHOTOT

IF (I.GT.20) WRITE (6,6) VBAR,VCOMP,RHOBAR

RETURN

C

6 FORMAT (1H0,34H1 EXCEEDS 20 ITERATIONS FOR RHOBAR,5X,7HVBAR = ,1PE

110.3,2X,8HVCOMP = ,1PE10.3,2X,9HRHOBAR = ,1PE10.3)

END



\$IBFTC READS. DEBUG,DECK

SUBROUTINE READS

C\*\*\*\*\*

C\*\*\* THIS SUBROUTINE READS ALL INPUT

C\*\*\*\*\*

```
EQUIVALENCE (T,TRD), (VXAX,VXAXRD), (VYAX,VYAXRD)
DIMENSION TRD(1), VXAXRD(1), VYAXRD(1), EODD(400), TITLE(12)
COMMON /RSAVE/ XDUM(400),YDUM(400),XAFF(200),YAFF(200)
1 ,MO,JA,IR,NRUNNO,MO2,JA2,IR2,NRUNO2
COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLO,NCHI
COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM
1IN,NSPLT,YWING
COMMON /WRT/ KSKIP,NT(2),NP(2)
COMMON /RDOUT2/ T(400,2),VYAX(200,2),VYCR(200),V2(400),V3(400),VZC
1R(200)
COMMON /RDOUT3/ VXAX(200,2),VXCR(200)
COMMON /RDOUT4/ NTHETA,THETA(10),XTEST(10)
COMMON /RCONT1/ VC,VINF,ALFAF,TTOTAL,ELND,VA,PT
COMMON /RCONT2/ PSTAT,TSTAT,WDOT,NX,KND,YRIHUB,YRISHR,UTIP
```

C\*\*\*\*\*

```
C READ NT(1) = NUMBER OF ON-BODY POINTS FOR CLOSED BODY SOLUTION
C NT(2) = NUMBER OF ON-BODY POINTS FOR OPEN-END SOLUTION
C NP(1) = NP(2) = TOTAL NUMBER OF OFF-BODY POINTS
C NID = NUMBER OF EOD I.D. CARDS
C KSKIP = 0 FOR 1 CASE OF COMBYN
C = 1 FOR SUCCESSIVE CASES USING THE SAME EOD OUTPUT
C N4SOL = 0 THREE (3) SOLUTIONS FROM EOD
C ( 2 FOR STREAMLINES ,1 FOR CROSSFLOW )
C = 1 FOUR (4) SOLUTIONS FROM EOD
C ( 2 FOR STREAMLINES, 2 FOR CROSSFLOW )
C NSPLT = NUMBER OF SPLITTERS (NOISE SUPPRESSION DEVICES )
C
C
C NSPB = RIGHT MOST POINT ON THE SPLITTER
C NSPE = LEFT MOST POINT ON THE SPLITTER
C
C ***** THE FIRST SPLITTER IS THE ONE CLOSEST TO THE HUB
C AND THE LAST SPLITTER IS THE ONE CLOSEST TO THE SHRO
C
```

C\*\*\*\*\*

```
READ (5,30) TITLE
READ (5,32) (NT(I),NP(I),I=1,2),NID,KSKIP,N4SOL,NSPLT
NPMIN=NP(1)
NTMIN=NT(2)
IF (NSPLT.NE.0) READ (5,32) (NSPB(I),NSPE(I),I=1,NSPLT)
READ (5,34) VC,VINF,ALFAF,TTOTAL,ELND,YWING,UTIP,VA,PT
READ (5,34) PSTAT,TSTAT,WDOT
READ (5,32) NTHETA,NCLO,NCHI,NX,KND
READ (5,34) (THETA(I),I=1,NTHETA)
READ (5,34) (XTEST(I),I=1,NX)
READ (5,36) XRI,YRIHUB,YRISHR,NHUBMX
DEBUG(NSPB(I),NSPE(I),I=1,NSPLT)
```

C\*\*\*\*\*

C\*\*\* IF KSKIP = 0 , READ DATA PUNCHED FROM EOD

C\*\*\*\*\*

```

IF (KSKIP.NE.0) GO TO 20
READ (5,38) MO,JA,IR,NRUNNO
DO 18 L=1,2
ILOON=1+400*(L-1)
IHION=ILOON+NT(L)-1
NTL=NT(L)
ILO=1+200*(L-1)
IHI=ILO+NP(L)-1
NPL=NP(L)
IF (L.EQ.1) GO TO 4
IF (NID.GT.1) GO TO 2
MO2=MO
JA2=JA
IR2=IR
NRUNO2=NRUNNO
GO TO 4
2  READ (5,38) MO2,JA2,IR2,NRUNO2
C*****
C***  READ OUTPUT FROM EOD  (BINARY RECORDS)
C*****
4  CALL BCREAD (XON(1),XON(NTL))
CALL BCREAD (YON(1),YON(NTL))
CALL BCREAD (TRD(ILOON),TRD(IHION))
CALL BCREAD (XOFF(1),XOFF(NPL))
CALL BCREAD (YOFF(1),YOFF(NPL))
CALL BCREAD (VXAXRD(ILO),VXAXRD(IHI))
CALL BCREAD (VYAXRD(ILO),VYAXRD(IHI))
CALL BCREAD (EODD(1),EODD(NPL))
IF (L.EQ.2) GO TO 6
CALL BCREAD (XON(1),XON(NTL))
CALL BCREAD (YON(1),YON(NTL))
CALL BCREAD (V2(ILOON),V2(IHION))
CALL BCREAD (V3(ILOON),V3(IHION))
CALL BCREAD (XOFF(1),XOFF(NPL))
CALL BCREAD (YOFF(1),YOFF(NPL))
CALL BCREAD (VXCR(ILO),VXCR(IHI))
CALL BCREAD (VYCR(ILO),VYCR(IHI))
CALL BCREAD (VZCR(ILO),VZCR(IHI))
GO TO 12
6  IF (N4SOL.EQ.0) GO TO 18
DO 8 I=1,4
CALL BCREAD (EODD(1),EODD(NTL))
8  CONTINUE
DO 10 I=1,5
CALL BCREAD (EODD(1),EODD(NPL))
10 CONTINUE
12 DO 14 I=1,NTL
XDUM(I)=XON(I)
14 YDUM(I)=YON(I)
DO 16 I=1,NPL
XAFF(I)=XOFF(I)
16 YAFF(I)=YOFF(I)
18 CONTINUE
20 WRITE (6,28) TITLE
WRITE (6,40) MO,JA,IR,NRUNNO,MO2,JA2,IR2,NRUNO2
CALL CONST

```

```

DO 22 I=1,NTMIN
XON(I)=XDUM(I)/ELND
22 YON(I)=YDUM(I)/ELND
DO 24 I=1,NPMIN
XOFF(I)=XAFF(I)/ELND
24 YOFF(I)=YAFF(I)/ELND
DO 26 I=1,NX
26 XTEST(I)=XTEST(I)/ELND
RETURN
C
C FORMATS
C
C
28 FORMAT (1H1,10X,30HCOMPRESSIBLE COMBYN APPROACH 5,10X,12A6)
30 FORMAT (12A6)
32 FORMAT (20I4)
34 FORMAT (10F8.3)
36 FORMAT (3F10.2,I4)
38 FORMAT (42X,3I2,I6)
40 FORMAT (1H0/25H BASED ON BASIC DATA FROM,I3,1H/,I2,1H/,I2,8H RUN N
10.,I6,4H AND,I3,1H/,I2,1H/,I2,8H RUN NO.,I6/)
END

```

\$1BFTC CONST. DEBUG,DECK

SUBROUTINE CONST

C  
C THIS SUBROUTINE CALCULATES MOST OF THE CONSTANTS USED IN COMBYN  
C

```
COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLO,NCHI
COMMON /RCONT2/ PSTAT,TSTAT,WDOT,NX,KND,YRIHUB,YRISHR,UTIP
COMMON /RCONT1/ VC,VINF,ALFAF,TTOTAL,ELND,VA,PT
COMMON /COUT1/ QCA,PTC,PSPTCI,PIO180,ATOTAL,GRHO
COMMON /COUT2/ VINF, RHOST, RHOSTOT, VIC
COMMON /WRT/ KSKIP,NT(2),NP(2)
COMMON /RDOT4/ NTHETA,THETA(10),XTEST(10)
COMMON /RDOT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM
1 IN,NSPLT,YWING
REAL MC,MA,MINF
PI=3.14159265
R21568=1715.63
G=32.174
PIO180=PI/180.
IF (PSTAT.NE.0.0.AND.TSTAT.NE.0.0) GO TO 2
IF (PT.EQ.0.0) PT=2116.22
IF (TTOTAL.EQ.0.0) TTOTAL=518.67
ATOTAL=49.*SQRT(TTOTAL)
CATOT=1.0-.2*(VINF/ATOTAL)**2
PSTATC=PT*CATOT**3.5
PTC=PT
RHOSTOT=PT/(R21568*TTOTAL)
TSTAT=TTOTAL*CATOT
RHOST=PSTATC/(R21568*TSTAT)
PSTAT=PT-.5*RHOST*VINF**2
ASTAT=49.*SQRT(TSTAT)
GO TO 4
2 ASTAT=49.0*SQRT(TSTAT)
PSTATC=PSTAT
RHOST=PSTAT/(R21568*TSTAT)
AMINF=VINF/ASTAT
CAMINF=1.0+.2*AMINF**2
PT=PSTAT+.5*RHOST*VINF**2
PTC=PSTAT*CAMINF**3.5
TTOTAL=TSTAT*CAMINF
RHOSTOT=PT/(R21568*TTOTAL)
ATOTAL=49.*SQRT(TTOTAL)
4 IF (WDOT.EQ.0.0) GO TO 6
AC=PI*(YRISHR**2-YRIHUB**2)/144.
VIC=WDOT/(G*RHOSTOT*AC)
VICC=ATOTAL/1.728
```

C\*\*\*\*\*

C\*\*\* FOR D. BREUNLIN TAKE OUT FOLLOWING THREE(3) CARDS 8/30/71

C\*\*\*\*\*

C IF(VIC.LE.VICC) GO TO 25

C VIC = VICC

```

C      WDOT = RHOTOT*VICC*AC*G
      CALL VBARIT (VIC,ATOTAL,RHOTOT,RHOC)
      VC=WDOT/(G*RHOC*AC)
6      IF (VA.EQ.0.0) VA=VC
C*****
C***   TESTS FOR NORMALIZING PARAMETERS (ELND)
C***   IF KND = -1, ELND = YRISHR
C***           0, SET ELND = 1.0 AND SKIP NONDIMENSIONAL CALCULATIO
C***           1, ELND = YRISHR - YRIHUB
C***           2, USE READ IN VALUE OF ELND
C***           4,5,6 USE VA FOR NONDIMENSIONALIZING VELOCITIES
C*****
      IF (KND.EQ.0) GO TO 8
      VCA=VC
      IF (KND.GE.4) VCA=VA
      WRITE (6,28) VC,VINF,VA,VCA,PT,TTOTAL
      VC=VC/VCA
      VA=VA/VCA
      VINF=VINF/VCA
      PT=1.0
      TTOTAL=TTOTAL/(VCA**2)
8      IF (KND.EQ.-1.OR.KND.EQ.4) ELND=YRISHR
      IF (KND.EQ.1.OR.KND.EQ.6) ELND=YRISHR-YRIHUB
      IF (KND.EQ.0.OR.KND.EQ.5) ELND=1.0
      XRI=XRI/ELND
      YRIHUB=YRIHUB/ELND
      YRISHR=YRISHR/ELND
      RTTOT=R21568*TTOTAL
      GRHO=32.174*PT/RTTOT
      C102RT=.5/RTTOT
      IF (PSTAT.NE.0.0) C102RT=.5*RHOST/PT
      VCOVA=VC/VA
      VIOVA=VINF/VA
      VNFOVC=VINF/VC
      VFOAT=VINF/ATOTAL
      VCOAT=VC/ATOTAL
      VAOAT=VA/ATOTAL
      CON1=1.0-.2*VCOAT**2
      CON2=1.0-.2*VFOAT**2
      CON3=1.0-.2*VAOAT**2
      RSORTF=CON2**2.5
      RSORTA=CON3**2.5
      RSORTC=CON1**2.5
      IF (WDOT.EQ.0.0) VIC = VC*RSORTC
      VSONIC=ATOTAL/1.728
      VSONCC=ATOTAL/SQRT(1.2)
      PSPTC=1.0-C102RT*VC**2
      PSPTIF=1.0-C102RT*VINF**2
      PSPTCI=RSORTF*CON2
      PSPTCC=RSORTC*CON1
      PSPTCA=RSORTA*CON3
      PSPTA=1.0-C102RT*VA**2
      MINF=VFOAT/(CON2**2.5)
      MC=VCOAT/(CON1**2.5)
      MA=VAOAT/(CON3**2.5)
      QINF=PT*(1.0-PSPTIF)

```

```

QCINF=PTC*(.7*VFOAT**2*RSORTF)
QC=PT*(1.0-PSPTC)
QCC=PTC*(.7*VCOAT**2*RSORTC)
QA=PT*(1.0-PSPTA)
QCA=PTC*(.7*VAOAT**2*RSORTA)
THETC=TTOTAL/518.67
DEL=PTC/2116.22
HBTPR=YRIHUB/YRISHR
WRITE (6,10)
WRITE (6,12) VC,MC,QC,QCC,PSPTC,PSPTCC,RSORTC
WRITE (6,14) VA,MA,QA,QCA,PSPTA,PSPTCA,RSORTA
WRITE (6,16) VINI,MINI,QINI,QCINI,PSPTIF,PSPTCI,RSORTF
WRITE (6,18)
WRITE (6,20) ALFAF,VNFOVC,VIOVA,VCOVA,VSONIC,VSONCC
WRITE (6,22)
WRITE (6,24) TSTAT,PSTAT,PSTATC,ASTAT,RHOST,WDOT,VIC
WRITE (6,18)
WRITE (6,26) TTOTAL,PT,PTC,ATOTAL,RHOTOT,THETC,DEL
WRITE (6,22)
WRITE (6,18)
WRITE (6,30) XRI,YRIHUB,YRISHR,HBTPR,ELND
WRITE (6,18)
WRITE (6,32) XTEST(1),YWING
WRITE (6,22)
WRITE (6,34) NT(1),NP(1),NCLO,NCHI,NHUBMX,NX,KND,KSKIP,NT(2),NP(2)

```

C  
C  
C

# FORMATS

C

## RETURN

10

```

FORMAT (1H0,27X,58HMACH DYNAMIC PRESSURE PRE
ISSURE RATIO/107H VELOCITY NO INC.
2 COMP. INC. COMP. DENSITY RATIO)

```

12

```

FORMAT (11H CONTROL ,1PE10.3,1P6E14.3)

```

14

```

FORMAT (11H BULK ,1PE10.3,1P6E14.3)

```

16

```

FORMAT (11H FREE ,1PE10.3,1P6E14.3/8H STREAM)

```

18

```

FORMAT (1H0)

```

20

```

FORMAT (87H ALFAF VINI/VC VINI/VA VC
1/VA VSONIC VSONICC/5X,1P6E14.3)

```

22

```

FORMAT (1H0,110H-----
1-----//)

```

24

```

FORMAT (100H TSTAT PSTAT PSTATC
1 ASTAT RHOSTAT WDOT VIC/9X,1PE10.3,1P6E14.3
2)

```

26

```

FORMAT (101H TTOT PTOT PTOTC
1 ATOT RHOTOT THET DEL/5X,1P7E14.3)

```

28

```

FORMAT (1H0,6E12.5)

```

30

```

FORMAT (75H XRI YRIHUB YRISHR HUB-T
1IP RATIO LND/5X,1P5E14.3)

```

32

```

FORMAT (31H XTEST YWING/5X,1P2E14.3)

```

34

```

FORMAT (74H NT NP NCLO NCHI NHUBMX
1 NX KND KSKIP/10X,1H1,14,5X,1H1,15,4X,13,5X,13,6X,13,6X,12,4
2X,12,6X,12/10X,1H2,14,5X,1H2,15)
END

```

\$IBFTC AVERV DECK,DEBUG

SUBROUTINE AVEV

C  
C APPROACH 5  
C

COMMON /MONOF/ JJS,JJ  
COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM  
1IN,NSPLT,YWING  
COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLD,NCHI  
COMMON /RDOUT2/ T(400,2),VYAX(200,2),VYCR(200),V2(400),V3(400),VZC  
1R(200)  
COMMON /RDOUT3/ VXAX(200,2),VXCR(200)  
COMMON /RDOUT4/ NTHETA,THETA(10),XTEST(10)  
COMMON /RCONT1/ VC,VINF,ALFAF,TTOTAL,ELND,VA,PT  
COMMON /RCONT2/ PSTAT,TSTAT,WDOT,NX,KND,YRIHUB,YRISHR,UTIP  
COMMON /COUT2/ VINF,PHOTOT,VIC  
COMMON /GETOUT/ VMAG(3),ALIL,BLIL,CLIL  
DIMENSION IBEGIN(25), IEND(25), VBAR(400), A(400), VBAROF(200), RH  
10BAR(400), RBROFF(200), RBORT(400), RBFORT(200)  
DIMENSION IED(25)  
REWIND 2  
REWIND 3  
PI=3.14159265  
PIO180=PI/180.  
G=32.174  
AC=PI\*(YRISHR\*\*2-YRIHUB\*\*2)/144.  
ATOTAL=49.\*SQRT(TTOTAL)  
FACTR=(144./G)/RPHOTOT  
NSHR=NTMIN-NHUBMX+1  
NBP1=NHUBMX+1

C\*\*\*\*\*  
C\*\*\* FIND THE HIGH-LIGHT ON THE SHROUD  
C\*\*\*\*\*

DO 2 I=NBP1,NTMIN  
JJ=I  
IF (XON(I).LE.XON(I+1)) GO TO 4  
2 CONTINUE

C\*\*\*\*\*  
C\*\*\* MODIFICATION FOR SPLITTER TO FIND THE LAST POINT ON THE SHROUD  
C\*\*\*\*\*

4 DO 6 I=JJ,NTMIN  
JJ=I  
IF (XON(I).GT.XON(I+1)) GO TO 8  
6 CONTINUE

C\*\*\*\*\*  
C\*\*\* FIND AREAS FOR POINTS ON THE SHROUD THEN INTERPOLATE FOR ALL  
C\*\*\* OTHER POINTS  
C\*\*\*\*\*

8 NHUBP1=NHUBMX+1  
IF (NSPLT.EQ.0) GO TO 12  
DO 10 IN=1,NSPLT  
IED(IN)=NSPB(IN+1)-1  
10 IF (IN.EQ.NSPLT) IED(IN)=NTMIN

C\*\*\*\*\*  
C\*\*\* FIND AREA FOR EVERY POINT ON THE SHROUD

```

C*****
12  DO 20 I=NHUBP1,JJS
    YS=YON(I)
    XS=XON(I)
    IF (I.GT.JJ) GO TO 18
    ARS=0.0
    IF (NSPLT.EQ.0) GO TO 16
C*****
C***  IF THERE ARE SPLITTERS, SUBTRACT AREA OF SPLITTERS FROM OVERALL AR
C*****
    DO 14 IN=1,NSPLT
    NSB=NSPB(IN)
    NSE=NSPE(IN)
    IF (XS.LT.XON(NSE).OR.XS.GT.XON(NSB)) GO TO 14
    CALL SINTP (XON(NSB),YON(NSB),NSE-NSB+1,XS,YSP1)
    CALL SINTP (XON(NSE),YON(NSE),IED(IN)-NSE,XS,YSP2)
    ARS=PI*(YSP2**2-YSP1**2)+ARS
14  CONTINUE
16  CALL SINTP (XON,YON,NHUBMX,XS,YH)
    A(I)=PI*(YS**2-YH**2)-ARS
    GO TO 20
18  R=SQRT(YS**2+(XS-XON(JJ))**2)
    A(I)=(1.0+(YS-YON(JJ))/(YON(JJS)-YON(JJ)))*PI*R*(R+XS-XON(JJ))
20  CONTINUE
C*****
C***  INTERPOLATE AREAS FROM THE POINTS ON THE SHROUD TO OBTAIN
C***  REMAINING AREAS
C*****
    NCNTH=0
    DO 24 I=1,NTMIN
    IF (I.GE.NHUBP1.AND.I.LE.JJS) GO TO 24
    IF (XON(I).LT.XON(JJ)) GO TO 22
    XA=XON(I)
    CALL SINTP (XON(NHUBP1),A(NHUBP1),JJ-NHUBMX,XA,AX)
    A(I)=AX
    GO TO 24
22  NCNTH=NCNTH+1
24  CONTINUE
    IF (NCNTH.EQ.0) GO TO 28
    DO 26 I=1,NCNTH
    A(I)=A(NCNTH+1)
26  CONTINUE
28  DO 50 N=1,NTHETA
    THETA(N)=THETA(N)*PI/180
    COSTH=COS(THETA(N))
    CCOSTH=CLIL*COSTH
    SINTH=SIN(THETA(N))
    CSINTH=CLIL*SINTH
    VICT=VIC+CLIL*VMAG(3)*COSTH
    WDOTT=G*RHOTOT*VICT*AC
    FACTOR=FACTR*WDOTT
    WRITE (3) WDOTT,VICT
C*****
C***  CALCULATE VBAR FOR EVERY POINT ON BODY
C*****
    ISTOP=NTMIN

```



```

SLOPE = (XON(JJS)-XON(JJ))/(YON(JJS)-YON(JJ))
DO 32 I=1,NTMIN
IF (I.GT.JJ.AND.I.LE.JJS.AND.SLOPE.GT.1.0) GO TO 30
VBAR(I)=FACTOR/A(I)
GO TO 32
30 VBAR(I)=VINFP
IF (VBAR(I).EQ.0.0) VBAR(I)=1.0
IF (ISTOP.EQ.NTMIN) ISTOP=I
32 CONTINUE
DEBUG(VBAR(I),I=1,NTMIN)

C
C CNBODY RHOBAR AND VRES CALCULATIONS
C
RRSRTF=RHOTOT*(1.0-.2*(VINFP/ATOTAL)**2)**2.5
RSORTC=(1.0-.2*(VC/ATOTAL)**2)**2.5
DO 38 I=1,NTMIN
VP=ALIL*T(I,1)+BLIL*T(I,2)+CCOSTH*V2(I)
VTH=CSINTH*V3(I)

C
C ORIGINAL VRESON
C
VRESON=SQRT(VP**2+VTH**2)
RESVV=VRESON

C
C APPROACH 5 VRESON
C
IF (I.GE.ISTOP.AND.I.LE.JJS) GO TO 34
CALL VBARIT (VBAR(I),ATOTAL,RHOTOT,RHOBAR(I))
GO TO 36
34 RHOBAR(I)=RRSRTF
36 RBORT(I)=RHOBAR(I)/RHOTOT
VRESON=VRESON*(1.0/RBORT(I))**((VRESON/VBAR(I)))
VP=VRESON*VP/RESVV
VTH=VRESON*VTH/RESVV
WRITE (3) VRESON,VP,VTH
38 CONTINUE
WRITE (2) (VBAR(I),RBORT(I),I=1,NTMIN)

C
C OFF BODY POINTS A AND VBAR
C
J=1
IBEGIN(J)=1
NRAKES=1
DO 42 I=1,NPMIN
IF (ABS(XOFF(I+1)-XOFF(I)).GT..01) GO TO 40
GO TO 42
40 J=J+1
IBEGIN(J)=I+1
NRAKES=J
42 CONTINUE
DO 46 I=1,NRAKES
IB=IBEGIN(I)

C*****
C*** FIND AREA FOR OFF-BODY RAKES
C*****

```

```

CALL SINTP (XON(NHUBP1),A(NHUBP1),JJ-NHUBMX,XOFF(IB),AR)
VB=FACTOR/AR
CALL VBARIT (VB,ATOTAL,RHOTOT,RHB)
IE=IBEGIN(I+1)-1
IF (I.EQ.NRAKES) IE=NPMIN
DO 44 J=IB,IE
VBAROF(J)=VB
RBROFF(J)=RHB
44 CONTINUE
46 CONTINUE
DO 48 I=1,NPMIN
C
C ORIGINAL VRESOF
C
VXC=ALIL*VXAX(I,1)+BLIL*VXAX(I,2)+CCOSTH*VXCR(I)
VYC=ALIL*VYAX(I,1)+BLIL*VYAX(I,2)+CCOSTH*VYCR(I)
VZC=CSINTH*VZCR(I)
VRESOF=SQRT(VXC**2+VYC**2+VZC**2)
RESVV=VRESOF
C
C APPROACH 5 VRESOF
RBFORT(I)=RBROFF(I)/RHOTOT
VRESOF=VRESOF*(1.0/RBFORT(I))*(VRESOF/VBAROF(I))
VXC=VRESOF*VXC/RESVV
VYC=VRESOF*VYC/RESVV
VZC=VRESOF*VZC/RESVV
WRITE (3) VRESOF,VXC,VYC,VZC
48 CONTINUE
WRITE (2) (VBAROF(I),RBFORT(I),I=1,NPMIN)
THETA(N)=THETA(N)/PI*180
50 CONTINUE
RETURN
END

```

\$IBFTC ONOFF. DECK

```

SUBROUTINE ONOFF
CALL ONBODY
CALL OFFBODY
RETURN
END

```

\$IBFTC ONBDY. DECK

SUBROUTINE ONBDY

C\*\*\*\*\*

C\*\*\* THIS SUBROUTINE CALCULATES ON-BODY VARIABLES

C\*\*\*\*\*

COMMON /MONOF/ JJS,JJ

COMMON /RDOU1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM  
1IN,NSPLT,YWING

COMMON /COUT1/ QCA,PTC,PSPTC1,PIO180,ATOTAL,GRHO

COMMON /CNOUT/ VRESO(400),VP(400),BETAON(400)

COMMON /RCNT2/ PSTAT,TSTAT,WDOT,NX,KND,YRIHUB,YRISHR,UTIP

DIMENSION VTH(400), PSOPTC(400), CPCON(400), VBAR(400), RBORT(400)  
1, S(400)

CALL SRTNE (XON,YON,XRI,YRIHUB,YRISHR,NHUBMX,NTMIN,S)

DO 10 I=1,NTMIN

C\*\*\*\*\*

C\*\*\* READ FROM TAPE 3 VRESO , VP , VTH

C\*\*\*\*\*

READ (3) VRESO(I),VP(I),VTH(I)

VCONC=.2\*(VRESO(I)/ATOTAL)\*\*2

IF (VCONC.GT.1.0) GO TO 2

PSOPTC(I)=(1.0-VCONC)\*\*3.5

GO TO 4

2 PSOPTC(I)=0.0

4 IF (VTH(I).EQ.0.0) GO TO 6

BETAON(I)=ATAN(VTH(I)/VP(I))/PIO180

GO TO 8

6 BETAON(I)=0.0

8 CPCON(I)=(PSOPTC(I)-PSPTC1)/(QCA/PTC)

10 CONTINUE

READ (2) (VBAR(I),RBORT(I),I=1,NTMIN)

C\*\*\*\*\*

C\*\*\* WRITE HUB COORDINATES AND VARIABLES

C\*\*\*\*\*

WRITE (6,14)

WRITE (6,16)

WRITE (6,18) (I,XON(I),YON(I),VP(I),VTH(I),VRESO(I),VBAR(I),BETAO  
1N(I),S(I),CPCON(I),RBORT(I),PSOPTC(I),I=1,NHUBMX)

C\*\*\*\*\*

C\*\*\* WRITE SHROUD COORDINATES AND VARIABLES

C\*\*\*\*\*

WRITE (6,20)

WRITE (6,16)

NHUBP1=NHUBMX+1

WRITE (6,18) (I,XON(I),YON(I),VP(I),VTH(I),VRESO(I),VBAR(I),BETAO  
1N(I),S(I),CPCON(I),RBORT(I),PSOPTC(I),I=NHUBP1,JJS)

C

C WRITE SPLITTER COORDINATES AND VARIABLES IF IT APPLIES

C

IF (NSPLT.EQ.0) GO TO 13

DO 12 IN=1,NSPLT

```

NB=NSPB(IN)
NE=NSPB(IN+1)-1
IF (IN.EQ.NSPLT) NE=NTMIN
WRITE (6,22) IN
WRITE (6,16)
WRITE (6,18) (1,XON(I),YON(I),VP(I),VTH(I),VRESON(I),VBAR(I),BETAO
IN(I),S(I),CPCON(I),RBORT(I),PSOPTC(I),I=NB,NE)
12 CONTINUE
13 CONTINUE
RETURN
C*****
C*** FORMATS
C*****
C
14 FORMAT (1H0,10X,3HHUB)
16 FORMAT (11X,14HON-BODY POINTS//2X,1HI,6X,1HX,11X,1HY,11X,2HVP,9X,6
1HVTHETA,7X,4HVRES,7X,5HVBARI,7X,4HBETA,10X,1HS,11X,3HCPC,5X,5HRB/R
2T,3X,6HPSOPTC)
18 FORMAT (I4,9E12.4,F7.4,F8.4)
20 FORMAT (1H0,10X,6HSHROUD)
22 FORMAT (1H0,10X,8HSPLITTER,I3)
END

```

\$IBFTC SSUB LIST,DECK

SUBROUTINE SRTNE (XON,YON,XRI,YRIHUB,YRISHR,NHUBMX,NTMIN,S)  
DIMENSION XON(1), YON(1), S(1)

```
C
C  S ROUTINE
C
  ISI=0
  2  ISI=ISI+1
     IF (XON(ISI)-XRI) 2,4,4
  4  S(ISI)=SQRT((XON(ISI)-XRI)**2+(YON(ISI)-YRIHUB)**2)
     ISI=ISI+1
     DO 6 I=ISI,NHUBMX
       S(I)=S(I-1)+SQRT((XON(I)-XON(I-1))**2+(YON(I)-YON(I-1))**2)
  6  CONTINUE
     IS2=ISI-1
     S(IS2)=-SQRT((XON(IS2)-XRI)**2+(YON(IS2)-YRIHUB)**2)
     IS3=ISI-2
     DO 8 I=1,IS3
       I39=IS2-I
       S(I39)=S(I39+1)-SQRT((XON(I39)-XON(I39+1))**2+(YON(I39)-YON(I39+1)
1) **2)
  8  CONTINUE
     ISI=NHUBMX
  10  ISI=ISI+1
     IF (XON(ISI)-XRI) 12,12,10
  12  S(ISI)=-SQRT((XON(ISI)-XRI)**2+(YON(ISI)-YRISHR)**2)
     ISI=ISI+1
     DO 14 I=ISI,NTMIN
       S(I)=S(I-1)-SQRT((XON(I)-XON(I-1))**2+(YON(I)-YON(I-1))**2)
  14  CONTINUE
     IS2=ISI-1
     S(IS2)=SQRT((XON(IS2)-XRI)**2+(YON(IS2)-YRISHR)**2)
     ISMIN=NHUBMX+1
     IS3=ISI-2
     DO 16 I=ISMIN,IS3
       I39=IS2-I+NHUBMX
       S(I39)=S(I39+1)+SQRT((XON(I39)-XON(I39+1))**2+(YON(I39)-YON(I39+1)
1) **2)
  16 CONTINUE
C
C  END OF S
C
  RETURN
  END
```

\$IBFTC OFBDY. DEBUG,DECK

SUBROUTINE OFFBDY

C  
C  
C

SUBROUTINE TO CALCULATE ALL OFF-BODY VARIABLES

COMMON /MONOF/ JJS,JJ  
COMMON /CNOUT/ VRESO(400),VP(400),BETAON(400)  
COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLO,NCHI  
COMMON /NOUT/ IBEGIN(25),IEND(25),NOEP(50,6),NOS(25),NRAKES  
COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM  
1 IN,NSPLT,YWING  
COMMON /GEABC/ YI  
COMMON /COUT1/ QCA,PTC,PSPTC I,PIO180,ATOTAL,GRHO  
COMMON /TOUT1/ SINTH,COSTH,OMEGA  
COMMON /RCONT2/ PSTAT,TSTAT,WDOT,NX,KND,YRIHUB,YRISHR,UTIP  
COMMON /VOUT1/ PSOPC(100),PHI(100),ZETA(100),VYI(100),CPC(100),V  
1 ZI(100),VMI(100),VAFTI(100),VSPANI(100),ETAI(100)  
COMMON /VOUT2/ UI(100),VZPRI(100),BETAPI(100),VPRI(100),VZPRST(100  
1),BETAPS(100),VPRST(100),MPRST(100),MPRI(100)  
DIMENSION X(100), VRES(100), VX(100), BETA(100), PSOP(100), ALFA(1  
100)  
DIMENSION QLOC(300), IQSJ(50), Q(50), DEV1(50), QFRACT(300), YLOC(  
1300)  
DIMENSION VBRFF(200), RBRTF(200), Y(100), QSTOT(50,6)  
DIMENSION VRESOF(200), VXC(200), VYC(200), VZC(200),  
1 PSOPTC(200),MPRIME(200),MPRIST(200),ALFAOF(200),  
2 BETAOF(200), VAFT(200), VSPAN(200), ETA(200),  
3 ZETA(200), PHI(200), VM(200),CPCOFF(200),  
4 U(200),VZPRIM(200),BETAPR(200),VPRIME(200),  
5 VZPRS(200),BETPS(200), VPRIST(200)  
REAL MPRIME,MPRIST,MPRST,MPRI  
PI=3.14159265  
O14=1.0/1.4  
GR044=GRHO/144.  
DO 8 I=1,NPMIN

C  
C  
C

READ FROM TAPE 3 VRESOF(I),VXC(I),VYC(I),VZC(I)

READ (3) VRESOF(I),VXC(I),VYC(I),VZC(I)

VCONA=.2\*(VRESOF(I)/ATOTAL)\*\*2

IF (VCONA.LE.1.0) GO TO 2

PSOPTC(I)=0.0

MPRIME(I)=0.0

MPRIST(I)=0.0

GO TO 4

2

PSOPTC(I)=(1.0-VCONA)\*\*3.5

4

ALFAOF(I)=ATAN(VYC(I)/VXC(I))/PIO180

BETAOF(I)=ARSIN(VZC(I)/VRESOF(I))/PIO180

VAFT(I)=VZC(I)\*SINTH+VYC(I)\*COSTH

VSPAN(I)=VYC(I)\*SINTH-VZC(I)\*COSTH

ETA(I)=ATAN2(VAFT(I),VXC(I))/PIO180

```

ZETA(I)=ATAN2(VSPAN(I),VXC(I))/PI0180
PHI(I)=ATAN2(VZC(I),VXC(I))/PI0180
VM(I)=SQRT(VXC(I)**2+VYC(I)**2)
CPCOFF(I)=(PSOPTC(I)-PSPTCI)/(QCA/PTC)

```

```

C
C IF THE OFF-BODY X IS NOT AT CONTROL STATION, SKIP FOLLOWING CALCUL
C

```

```

IF (XOFF(I).NE.XRI) GO TO 8
U(I)=OMEGA*YOFF(I)
VZPRIM(I)=VZC(I)-U(I)
BETAPR(I)=ATAN2(VZPRIM(I),VM(I))
VPRIME(I)=VM(I)/COS(BETAPR(I))
BETAPR(I)=BETAPR(I)/PI0180

```

```

VCON=VPRIME(I)/ATOTAL
IF (VCONA.GT.1.0) GO TO 6
MPRIME(I)=VCON/((1.0-VCONA)**.5)

```

```

6 VZPRS(I)=-VZC(I)-U(I)
BETPS(I)=ATAN2(VZPRS(I),VM(I))
VPRIST(I)=VM(I)/COS(BETPS(I))
BETPS(I)=BETPS(I)/PI0180
VPCON=VPRIST(I)/ATOTAL
IF (VCONA.GT.1.0) GO TO 8
MPRIST(I)=VPCON/((1.0-VCONA)**.5)

```

```

8 CONTINUE
CALL NOEPTS

```

```

C*****
C*** I = COUNT FOR INTERPOLATED OFF-BODY POINTS
C*** IK LOOP FOR NUMBER OF RAKES
C*****

```

```

I=0
DO 30 IK=1,NRAKES
NOSI=NOS(IK)
IB=IBEGIN(IK)

```

```

C*****
C*** IS = STARTING POINT TO FIND ON-BODY X VALUE
C*** ISP = STOPPING POINT TO FIND ON-BODY X VALUE
C*** K = COUNT FOR NUMBER OF ENDPOINTS FOR RAKE
C*****

```

```

NS=0
DO 28 K=1,NOSI
IF (K.GT.1) GO TO 10
IS=1
ISP=NHUBMX
GO TO 20
10 IF (K.EQ.NOSI) GO TO 18
IF (MOD(K,2).EQ.0) GO TO 12
IS=NSPE(NS)
ISP=NSPB(NS+1)-1
IF (K.EQ.NOSI-1) ISP=NTMIN
GO TO 20
12 NS=NS+1
14 IS=NSPB(NS)
ISP=NSPE(NS)
IF (XOFF(IB).GT.XON(IS).OR.XOFF(IB).LT.XON(ISP)) GO TO 16
GO TO 20
16 NS=NS+1

```

```

      GO TO 14
18    IS=NHUBMX+1
      ISP=JJ
C
C    DO LOOP TO SEARCH FOR ON-BODY X VALUES NEAREST TO OFF-BODY X VALUE
C
20    I=I+1
      X(I)=XOFF(IB)
      IFLAG=2
      DO 26 J=IS,ISP
      IF (MOD(K,2).EQ.0) GO TO 22
C
C    SEARCHING FORWARD - TOP-SIDE OF A BODY
C
      IF (X(I).LE.XON(IS)) GO TO 24
      IF (XON(J).LT.X(I)) GO TO 26
      CALL INTPOL (1,J,X(I),IFLAG,VX(I),VRES(I),BETA(I),ALFA(I))
      PSOPC(I)=(1.0-.2*(VRES(I)/ATOTAL)**2)**3.5
      Y(I)=YI
      CALL VAROFF (I,BETA,ALFA,VX,VRES,X,Y)
      GO TO 28
C
C    SEARCHING BACKWARD - UNDERSIDE OF A BODY
C
22    IF (XON(J).GT.X(I)) GO TO 26
      IND=J-1
      CALL INTPOL (1,J,X(I),IFLAG,VX(I),VRES(I),BETA(I),ALFA(I))
      PSOPC(I)=(1.0-.2*(VRES(I)/ATOTAL)**2)**3.5
      Y(I)=YI
      BETA=-BETA(I)
      VX(I)=-VX(I)
      CALL VAROFF (I,BETA,ALFA,VX,VRES,X,Y)
      GO TO 28
24    Y(I)=0.0
      VX(I)=VXC(IB)
      VRES(I)=VRESOF(IB)
      BETA(I)=BETAOF(IB)
      ALFA(I)=ALFAOF(IB)
      PSOPC(I)=PSOPTC(IB)
      GO TO 28
26    CONTINUE
28    CONTINUE
30    CONTINUE
C*****
C***  INTEGRATED WEIGHT FLOW BETWEEN LOWER BOUNDARY(EITHER HUB OR AXIS)
C***      AND LOCAL Y VALUE
C***  NIO  = NUMBER OF INTERPOLATED OFF BODY POINT
C*****
      NIO=0
      IQS=0
      DO 42 J=1,NRAKES
      IQS=IQS+1
      QLOC(IQS)=0.0
      NOSI=NOS(J)
      QST=0.0
      DO 40 NS=1,NOSI,2

```



```

NIO=NIO+1
NLOW=NOEP(J,NS)
NHI=NOEP(J,NS+1)
NHIM1=NHI-1
IQS=IQS+1
QLOC(IQS)=PI*(PSOPTC(NLOW)**014*(YOFF(NLOW)*VXC(NLOW))+PSOPC(NIO)*
1*014*(Y(NIO)*VX(NIO)))*(YOFF(NLOW)-Y(NIO))+QST
DO 32 I=NLOW,NHIM1
  IQS=IQS+1
  QLOC(IQS)=QLOC(IQS-1)+PI*(PSOPTC(I+1)**014*(YOFF(I+1)*VXC(I+1))+PS
1OPTC(I)**014*(YOFF(I)*VXC(I)))*(YOFF(I+1)-YOFF(I))
32  CONTINUE
  NIO=NIO+1
  IQS=IQS+1
  IF (X(NIO).LT.XON(JJ)) GO TO 34
  QLOC(IQS)=QLOC(IQS-1)+PI*(PSOPC(NIO)**014*(Y(NIO)*VX(NIO))+PSOPTC(
1NHI)**014*(YOFF(NHI)*VXC(NHI)))*(Y(NIO)-YOFF(NHI))
  QST=QLOC(IQS)
  GO TO 36
34  QLOC(IQS)=QLOC(IQS-1)
  QST=QLOC(IQS)
36  IF (NS.EQ.NOSI-1) GO TO 38
  IQS=IQS+1
  QLOC(IQS)=QLOC(IQS-1)
38  QSTOT(J,NS)=QST
40  CONTINUE
  IQSJ(J)=IQS-IQSAVE
  IQSAVE=IQS
  IF (J.EQ.1) IQSJ(J)=IQS
  Q(J)=QST
42  CONTINUE
  DO 44 I=1,IQS
  QLOC(I)=QLOC(I)*GR044
44  CONTINUE
  SUM=0.0
  DO 46 I=1,NRAKES
  Q(I)=Q(I)*GR044
  IF (IBEGIN(I).NE.NCLO) GO TO 46
  QBAR=Q(I)
46  CONTINUE
  DO 48 I=1,NRAKES
  DEV1(I)=(Q(I)-QBAR)/QBAR
48  CONTINUE
  IST=1
  IFN=IQSJ(1)
  DO 52 I=1,NRAKES
  DO 50 J=IST,IFN
  QFRACT(J)=QLOC(J)/Q(I)
50  CONTINUE
  IST=IFN+1
  IFN=IFN+IQSJ(I+1)
52  CONTINUE
C
C  WRITE OFF-BODY DATA
C
  READ (2) (VBRFF(I),RBRTF(I),I=1,NPMIN)

```

```

WRITE (6,82)
NIO=0
DO 58 I=1,NRAKES
NOSI=NOS(I)
DO 56 NS=1,NOSI,2
NLOW=NOEP(I,NS)
NHI=NOEP(I,NS+1)
54 NIO=NIO+1
WRITE (6,84) X(NIO),Y(NIO),VX(NIO),VYI(NIO),VZI(NIO),VRES(NIO),VMI
1(NIO),VAFTI(NIO),VSPANI(NIO),PSOPC(NIO)
IF (MOD(NIO,2).EQ.0) GO TO 56
WRITE (6,86) (J,XOFF(J),YOFF(J),VXC(J),VYC(J),VZC(J),VRESOF(J),VM(
1J),VAFT(J),VSPAN(J),RBRTF(J),PSOPTC(J),J=NLOW,NHI)
GO TO 54
56 CONTINUE
58 CONTINUE
WRITE (6,88)
NIO=0
NQ=0
DO 66 I=1,NRAKES
NOSI=NOS(I)
DO 64 NS=1,NOSI,2
NLOW=NOEP(I,NS)
NHI=NOEP(I,NS+1)
60 NIO=NIO+1
NQ=NQ+1
YLOC(NQ) = Y(NIO)
WRITE (6,90) X(NIO),Y(NIO),CPC(NIO),ALFA(NIO),BETA(NIO),ETAI(NIO),
1ZETA(NIO),PHII(NIO),QFRACT(NQ)
IF (MOD(NIO,2).EQ.0) GO TO 64
DO 62 J=NLOW,NHI
NQ=NQ+1
YLOC(NQ) = YOFF(J)
WRITE (6,92) J,XOFF(J),YOFF(J),VBRFF(J),CPCOFF(J),ALFAOF(J),BETAOF
1(J),ETA(J),ZETA(J),PHI(J),QFRACT(NQ)
62 CONTINUE
GO TO 60
64 CONTINUE
66 CONTINUE
C
C WRITE OFF-BODY DATA AT THE CONTROL STATION
C
WRITE (6,94) XRI,UTIP
NIO=0
DO 74 I=1,NRAKES
NOSI=NOS(I)
DO 72 NS=1,NOSI,2
NLOW=NOEP(I,NS)
NHI=NOEP(I,NS+1)
68 NIO=NIO+1
IF (X(NIO).NE.XRI) GO TO 70
WRITE (6,96) Y(NIO),UI(NIO),VZPRI(NIO),VPRI(NIO),MPRI(NIO),BETAPI(
1NIO),VZPRST(NIO),VPRST(NIO),MPRST(NIO),BETAPS(NIO)
IF (MOD(NIO,2).EQ.0) GO TO 72
WRITE (6,96) (YOFF(J),U(J),VZPRIM(J),VPRIME(J),MPRIME(J),BETAPR(J)
1,VZPRS(J),VPRIST(J),MPRIST(J),BETPS(J),J=NLOW,NHI)

```

```

GO TO 68
70 NIO=NIO+1
72 CONTINUE
74 CONTINUE
C
C WRITE WEIGHT FLOW DATA
C
WRITE (6,102)
NIO=0
DO 80 I=1,NRAKES
NOSI=NOS(I)
DO 78 J=1,NOSI,2
NIO=NIO+2
QSTOT(I,J)=QSTOT(I,J)*GR044
QFR=QSTOT(I,J)/Q(I)
IF (J.GT.1) GO TO 76
WRITE (6,98) I,X(NIO),DEV1(I),QSTOT(I,J),QFR
GO TO 78
76 WRITE (6,100) QSTOT(I,J),QFR
78 CONTINUE
80 CONTINUE
CALL STRML (YLOC,QFRACT,IQSJ,NRAKES,XOFF,NDEP)
RETURN

C*****
C*** FORMATS
C*****
C
82 FORMAT (1H1,5X,23HOFF-BODY POINTS (RAKES)/
* 1H0,10X,116HCOORDINATES *-----
1-----VELOCITIES-----* PRESS.R
2ATIO/123H AXIAL RADIAL AXIAL RADIAL CIRCUMF
3RNTL RESULTANT MERIDIONAL CHORDWISE SPANWISE COMP
4/129H I X Y VX VY VZ
5 VRES VM VAFT VSPAN RHOBR PSOP
6TC)
84 FORMAT (5X,1P9E12.4,7X,0PF8.4)
86 FORMAT (15,1P9E12.4,0PF7.4,0PF8.4)
88 FORMAT (/1H0,112H COORDINATES NEW CP
1 *-----ANGLES-----*/1
209H AXIAL RADIAL MERIDIONA
3L FLOW UNDERTURN SPANWISE SWIRL/122H I X
4 Y VTRI CPC ALPHA BETA
5ETA ZETA PHI QFRACT)
90 FORMAT (5X,1P2E12.4,12X,1P7E12.4)
92 FORMAT (15,1P10E12.4)
94 FORMAT (1HL 5X,25HRELATIVE ROTOR INLET DATA/
* 1H0,14H X = ,F10.4,17H UTIP = ,F10.4//12
12H Y U VZPRIME VPRIM MPRIME
2 BETAPR VZPRST VPRST MPRS BETAPS)
96 FORMAT (5X,1P10E12.4)
98 FORMAT (18,2X,1PE11.4,5X,1PE11.4,6X,1PE11.4,2X,1PE11.4)
100 FORMAT (43X,1PE11.4,2X,1PE11.4)
102 FORMAT (1HL,5X,21HRAKE WEIGHT FLOW DATA/
* 1H0,63H I X (Q(I)-QBAR)/QBAR QS TOT
1 QFR)
END

```

\$IBFTC NOEPT.  DEBUG,DECK.

SUBROUTINE NOEPTS

C\*\*\*\*\*

C\*\*\* THIS SUBROUTINE IS TO FIND THE END POINTS - FOR RAKES NEAR HUB,  
C\*\*\* SHROUD AND/OR SPLITTERS

C\*\*\* NOS = THE NUMBER OF END POINTS FOR EACH RAKE = 2\*NO. OF SPLITTE  
C\*\*\* + 2 (HUB AND SHROUD)

C\*\*\* NOEP = THE INDEX OF THE RAKE ENDPOINTS

C\*\*\*\*\*

COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLO,NCHI

COMMON /NOUT/ IBEGIN(25),IEND(25),NOEP(50,6),NQS(25),NRAKES

COMMON /RDOUT1/ XON(400),YON(400),NSPE(10),NSPB(10),XRI,NHUBMX,NTM  
LIN,NSPLT,YWING

J=1

IBEGIN(1)=1

NPMNM1=NPMIN-1

DO 4 I=1,NPMNM1

IF (ABS(XOFF(I+1)-XOFF(I)).GT..01) GO TO 2

GO TO 4

2 IEND(J)=I

J=J+1

IBEGIN(J)=I+1

4 CONTINUE

NRAKES=J

IEND(J)=NPMIN

C\*\*\*\*\*

C\*\*\* FIND THE END POINTS OF THE SPLITTER

C\*\*\*\*\*

DO 10 I=1,NRAKES

IB=IBEGIN(I)

IE=IEND(I)

IEM1=IE-1

DYTEST=ABS(YOFF(IB)-YOFF(IB+1))

C\*\*\*\*\*

C\*\*\* NS IS THE COUNTER TO DETERMINE NUMBER OF END POINTS PER RAKE

C\*\*\* NOEP IS THE END POINT INDEX.

C\*\*\*\*\*

NS=1

NOEP(I,1)=IB

IF (NSPLT.EQ.0) GO TO 8

DO 6 K=IB,IEM1

IF (ABS(ABS(YOFF(K+1)-YOFF(K))-DYTEST).LE.1.0E-4) GO TO 6

NS=NS+1

NOEP(I,NS)=K

NS=NS+1

NOEP(I,NS)=K+1

DYTEST=ABS(YOFF(K+1)-YOFF(K+2))

6 CONTINUE

8 NS=NS+1

NOEP(I,NS)=IE

NQS(I)=NS

10 CONTINUE

RETURN

END

\$IBFTC VAROF. DEBUG,DECK

```
SUBROUTINE VAROFF (I,BETA,ALFA,VX,VRES,X,Y)
  DIMENSION BETA(1), ALFA(1), VX(1), VRES(1), X(1), Y(1)
  COMMON /TOUT1/ SINTH,COSTH,OMEGA
  COMMON /NIN/ XOFF(200),YOFF(200),NPMIN,NCLO,NCHI
  COMMON /COUT1/ QCA,PTC,PSPTCI,PIO180,ATOTAL,GRHO
  COMMON /VOUT1/ PSOPC(100),PHII(100),ZETAI(100),VYI(100),CPC(100),V
  1ZI(100),VMI(100),VAFTI(100),VSPANI(100),ETAI(100)
  COMMON /VOUT2/ UI(100),VZPRI(100),BETAPI(100),VPRI(100),VZPRST(100
  1),BETAPS(100),VPRST(100),MPRST(100),MPRI(100)
  REAL MPRST,MPRI
  VCAN=.2*(VRES(1)/ATOTAL)**2
  IF (VCAN.LE.1.0) GO TO 2
  PSOPC(1)=0.0
  MPRI(1)=0.0
  MPRST(1)=0.0
  GO TO 4
2  PSOPC(1)=(1.0-VCAN)**3.5
4  VYI(1)=VX(1)*TAN(ALFA(1)*PIO180)
  CPC(1)=(PSOPC(1)-PSPTCI)/(QCA/PTC)
  VZI(1)=VRES(1)*SIN(BETA(1)*PIO180)
  VMI(1)=SQRT(VX(1)**2+VYI(1)**2)
  VAFTI(1)=VZI(1)*SINTH+VYI(1)*COSTH
  VSPANI(1)=VYI(1)*SINTH-VZI(1)*COSTH
  ETAI(1)=ATAN2(VAFTI(1),VX(1))/PIO180
  ZETAI(1)=ATAN2(VSPANI(1),VX(1))/PIO180
  PHII(1)=ATAN2(VZI(1),VX(1))/PIO180
C
C  IF X IS NOT AT THE CONTROL STATION SKIP FOLLOWING CALCULATIONS
C
  IF (X(1).NE.XOFF(NCLO)) RETURN
  UI(1)=OMEGA*Y(1)
  VZPRI(1)=VZI(1)-UI(1)
  BETAPI(1)=ATAN2(VZPRI(1),VMI(1))
  VPRI(1)=VMI(1)/COS(BETAPI(1))
  BETAPI(1)=BETAPI(1)/PIO180
  IF (VCAN.GT.1.0) GO TO 6
  VCON=VPRI(1)/ATOTAL
  MPRI(1)=VCON/((1.0-VCAN)**.5)
6  VZPRST(1)=-VZI(1)-UI(1)
  BETAPS(1)=ATAN2(VZPRST(1),VMI(1))
  VPRST(1)=VMI(1)/COS(BETAPS(1))
  BETAPS(1)=BETAPS(1)/PIO180
  IF (VCAN.GT.1.0) RETURN
  VPCON=VPRST(1)/ATOTAL
  MPRST(1)=VPCON/((1.0-VCAN)**.5)
  RETURN
END
```

\$IBFTC STRML. DEBUG

```
      SUBROUTINE STRML (Y,Q,IQ,NRAKES,X,N)
      DIMENSION Y(1), Q(1), IQ(1), X(1), N(1,1)
C
C      THIS SUBROUTINE CALCULATES STREAMLINES
C
      WRITE (6,6)
      DELQ=.02
      IST=1
      IFN=IQ(1)
      DO 4 I=1,NRAKES
      NQ=N(I,1)
      QSTRM=DELQ
      WRITE (6,8) X(NQ)
2      CALL SINTP (Q(IST),Y(IST),IFN-IST+1,QSTRM,YSTRM)
      WRITE (6,10) QSTRM,YSTRM
      QSTRM=QSTRM+DELQ
      IF (QSTRM.LE.1.0) GO TO 2
      IST=IFN+1
      IFN=IFN+IQ(I+1)
4      CONTINUE
      RETURN
C
6      FORMAT (1H0,10X,11HSTREAMLINES/)
8      FORMAT (1H0,10X,4HX = ,F7.3/10X,5HQSTRM,10X,5HYSTRM)
10     FORMAT (5X,1PE12.5,6X,1PE12.5)
      END
```

LISTING OF INPUT CARDS FOR TEST CASE

# SCIRCL INPUT

TEST CASE										
TEST 1	2.0	.25	1.0	6.0						
2.0	2.5	5.0	6							
4.0	2.75	4.75	9							
6.0	2.75	4.75	9							
1.0	5.0									
1.0	0.0	0.0	0.0	.50						
2.5	0.0	0.0	0.0	.50	.25	1.5	2.0	2.0	3.5	2.25
1.0	2.0	2.0	3.5	2.25						
0.0	2.0	2.0	3.5	2.25	4.5	2.39	6.0	2.5	12.	2.5
1.0	6.0	2.5	12.	2.5						
2.0	5.0									
1.0	12.	5.0	6.0	5.0						
1.0	6.0	5.0	5.0	5.0						
-3.0	6.0	5.0	5.0	5.0	2.0	5.5	0.0	5.5		
-1.0	4.0	5.5	2.0	5.5	0.0	6.65	1.699	30.		
1.0	0.0	6.65	0.0	20.						

## EOD INPUT

THESE CARDS ARE ALL PUNCHED BY PROGRAM SCIRCL

TEST CASE						3-800Y	TEST 1
3 1110							TEST 1
41							TEST 1
1	0						TEST 1
0.	0.	-0.	0.016758	0.075506	0.177876		TEST 1
0.316638	0.483249	0.664451	0.863316	1.075317	1.297026		
1.525978	1.760536	2.000000	2.250000	2.500000	2.750000		
3.000000	3.250000	3.500000	3.749816	3.998633	4.248171		
4.498234	4.748669	4.999341	5.250110	5.500776	5.750977		
6.000000	6.254089	6.558996	6.924884	7.363950	7.890829		
8.523084	9.281790	10.192237	11.096118	12.000000			
0.	0.250000	0.500000	0.750708	0.961274	1.151886		
1.319440	1.464105	1.583985	1.687325	1.774846	1.847875		
1.908128	1.957771	2.000000	2.041667	2.083333	2.125000		
2.166667	2.208333	2.250000	2.289805	2.326024	2.359299		
2.389795	2.417534	2.442390	2.464049	2.481898	2.494743		
2.500000	2.500000	2.500000	2.500000	2.500000	2.500000		
2.500000	2.500000	2.500000	2.500000	2.500000	2.500000		
60							TEST 1
2	0						TEST 1
12.000000	11.096118	10.192237	9.281790	8.523084	7.890829		
7.363950	6.924884	6.558996	6.254089	6.000000	5.750000		
5.500000	5.250000	5.000000	4.758758	4.505645	4.240505		
3.963951	3.677557	3.383893	3.089105	2.801122	2.522935		
2.256492	2.000000	1.773871	1.572897	1.379335	1.194856		
1.018986	0.851496	0.694532	0.547348	0.414819	0.296525		
0.194941	0.112475	0.051336	0.013387	0.	0.		
0.	0.	0.	0.	0.	0.		
0.	0.	0.	0.	0.	0.		
0.	0.	0.	0.	0.	0.		
5.000000	5.000000	5.000000	5.000000	5.000000	5.000000		
5.000000	5.000000	5.000000	5.000000	5.000000	5.000000		
5.000000	5.000000	5.000000	5.009180	5.036257	5.079913		
5.137711	5.205818	5.278969	5.350155	5.412077	5.459720		
5.489660	5.500000	5.500939	5.506328	5.519450	5.542613		
5.577614	5.625974	5.688220	5.765821	5.857039	5.962749		
6.081901	6.212809	6.353156	6.500028	6.650000	6.832585		
7.051688	7.314611	7.630119	8.008728	8.463059	9.008256		
9.662493	10.447577	11.389678	12.346381	13.303083	14.259785		
15.216488	16.173190	17.129892	18.086594	19.043297	20.000000		
4							TEST 1
3	0						TEST 1
12.000000	12.000000	12.000000	12.000000				
2.500000	3.333333	4.166667	5.000000				
24							TEST 1
0	0						TEST 1
2.000000	2.000000	2.000000	2.000000	2.000000	2.000000		
4.000000	4.000000	4.000000	4.000000	4.000000	4.000000		
4.000000	4.000000	4.000000	6.000000	6.000000	6.000000		
6.000000	6.000000	6.000000	6.000000	6.000000	6.000000		
2.500000	3.000000	3.500000	4.000000	4.500000	5.000000		
2.750000	3.000000	3.250000	3.500000	3.750000	4.000000		
4.250000	4.500000	4.750000	5.000000	5.250000	5.500000		
3.500000	3.750000	4.000000	4.250000	4.500000	4.750000		



2 1 10 TEST CASE

2-BODY TEST 1

TEST 1  
TEST 1  
TEST 1  
TEST 1  
TEST 1  
TEST 1  
TEST 1

41						
1		1				
60						
2		1				
24						
0		0				
2.000000	2.000000	2.000000	2.000000	2.000000	2.000000	2.000000
4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000
4.000000	4.000000	4.000000	6.000000	6.000000	6.000000	6.000000
6.000000	6.000000	6.000000	6.000000	6.000000	6.000000	6.000000
2.500000	3.000000	3.500000	4.000000	4.500000	5.000000	5.000000
2.750000	3.000000	3.250000	3.500000	3.750000	4.000000	4.000000
4.250000	4.500000	4.750000	2.750000	3.000000	3.250000	3.250000
3.500000	3.750000	4.000000	4.250000	4.500000	4.750000	4.750000

# COMBYN INPUT

TEST - 1							
102	24	99	24	1			
700.	0.0		0.0	0.0	0.0	0.0	900.
0.0	0.0		0.0				
1	16	24					
0.0							
6.0	2.5		5.0		40		

HERE INSERT BINARY RECORD CARDS PUNCHED BY PROGRAM EOD

TEST-1							
102	24	99	24	1	1		
700.	100.		0.0	0.0	0.0	0.0	900.
0.0	0.0		0.0				
3	16	24					
0.0	90.		180.				
0.0							
6.0	2.5		5.0		40		

PRINTED OUTPUT FOR TEST CASE

SCIRCL

CASE TEST 1

NO. OF BODIES = 2. DELS = 0.250 DELSMX = 1.000 XRI = 6.000000

\*\*\*\* HLB \*\*\*\*\*

ENREED 1.000 X 0.0. STRAIGHT LINE  
Y 0.0. 5.0000E-01  
ENREED 2.500 X 0.0. SUPERELLIPSE  
Y 0.0. 5.0000E-01 2.5000E-01 2.0000E+00 2.0000E+00 3.5000E+00 2.2500E+00

N = 0.25000000E+01 A = 0.11666667E+01 B = 0.20000000E+01  
XC = -0.83333333E+00 Y0 = 0.20000000E+01 OMEGA = -0.16514868E+00

2 ITERATIONS---  
CELS IN = 0.25000 CELS = 0.25071 DELS OUT = 0.25071 DSTEST = 0.24316

ENREED 1.000 X 2.0000E+00 3.5000E+00  
Y 2.0000E+00 2.2500E+00  
ENREED 0.0. X 2.0000E+00 3.5000E+00 6.0000E+00 1.2000E+01  
Y 2.0000E+00 2.2500E+00 2.5000E+00 2.5000E+00

N = 0.20638183E+01 A = 0.15206905E+01 B = 0.16439900E+00  
XC = -0.50708462E+00 Y0 = 0.21643990E+01 OMEGA = -0.14056477E+01

2 ITERATIONS---  
CELS IN = 0.25345 CELS = 0.25409 DELS OUT = 0.25409 DSTEST = 0.24908

ENREED 1.000 X 6.0000E+00 1.2000E+01  
Y 2.5000E+00 2.5000E+00  
ENREED 1.000 X 1.2000E+01 6.0000E+00  
Y 5.0000E+00 5.0000E+00  
ENREED 1.000 X 6.0000E+00 5.0000E+00  
Y 5.0000E+00 5.0000E+00  
ENREED -3.000 X 6.0000E+00 5.0000E+00 2.0000E+00 0.0. 5.5000E+00  
Y 5.0000E+00 5.0000E+00 5.5000E+00 5.5000E+00

\*\*\*\* SHRCUD \*\*\*\*\*

2 ITERATIONS A = 3.70370E-02 B = -3.88889E-01 C = 1.11111E+00 D = 4.53704E+00  
CELS IN = 0.25000 CELS = 0.25675 DELS OUT = 0.25675 DSTEST = 0.23895

ENREED -1.000 X 4.0000E+00 2.0000E+00 0.0. 2.0000E+00  
Y 5.5000E+00 5.5000E+00 6.6500E+00 6.6500E+00  
12 ITERATIONS---  
THEMPCALC = 0.52183 ACALC = 1.75478

DELTA IN = 0.25675 DELS = 0.22174 DELS OUT = 0.18259 DSTEST = C.00001

ENRBC  
1.000  
X  
Y

STRAIGHT LINE  
0.  
6.6500E+00

0.  
2.0000E+01

INPUT FOR THE COMBINE PROGRAM NT(1)= 102 NT(2)= 99 NHUBMX= 40 NP= 24

BODY 1 CO-ORDINATES - X		Y		KAPPA		DY/DX		ALPHA		S		S-S(2)		DELTA	
1	C.	0.	0.	0.	0.	0.9959E+05	0.9000E+02	0.	0.	0.72835E+01	0.	0.	0.	0.	0.
2	C.	0.2500E+00	0.	0.	0.	0.9959E+05	0.9000E+02	0.	0.	-0.70335E+01	0.	0.	0.	0.2500E+00	0.
3	-C.	0.5000E+00	-0.12455E-03	0.	0.	0.9990E+03	0.9000E+02	0.	0.	-0.67835E+01	0.	0.	0.	0.2500E+00	0.
4	C.	0.75071E+00	-0.92797E+00	0.	0.	0.60470E+01	0.80010E+02	0.	0.	-0.65322E+01	0.	0.	0.	0.25127E+00	0.
5	C.	0.16758E-01	0.96127E+00	-0.10310E+01	0.	0.24753E+01	0.68001E+02	0.	0.	-0.63136E+01	0.	0.	0.	0.21861E+00	0.
6	C.	0.77506E-01	0.11519E+01	-0.91960E+00	0.	0.14690E+01	0.55756E+02	0.	0.	-0.60973E+01	0.	0.	0.	0.21636E+00	0.
7	C.	0.17788E+00	0.13154E+01	-0.74713E+00	0.	0.10132E+01	0.45348E+02	0.	0.	-0.58797E+01	0.	0.	0.	0.21755E+00	0.
8	C.	0.38325E+00	0.14641E+01	-0.59194E+00	0.	0.75120E+00	0.36514E+02	0.	0.	-0.56591E+01	0.	0.	0.	0.22645E+00	0.
9	C.	0.66445E+00	0.15840E+01	-0.47508E+00	0.	0.58445E+00	0.30304E+02	0.	0.	-0.54418E+01	0.	0.	0.	0.21727E+00	0.
10	C.	0.86332E+00	0.16873E+01	-0.38556E+00	0.	0.46216E+00	0.24805E+02	0.	0.	-0.52177E+01	0.	0.	0.	0.22411E+00	0.
11	C.	0.10753E+01	0.17748E+01	-0.31607E+00	0.	0.36817E+00	0.20212E+02	0.	0.	-0.49883E+01	0.	0.	0.	0.22936E+00	0.
12	C.	0.12970E+01	0.18479E+01	-0.25871E+00	0.	0.29390E+00	0.16378E+02	0.	0.	-0.47549E+01	0.	0.	0.	0.23363E+00	0.
13	C.	0.15260E+01	0.19081E+01	-0.20539E+00	0.	0.23510E+00	0.13230E+02	0.	0.	-0.45182E+01	0.	0.	0.	0.23675E+00	0.
14	C.	0.17605E+01	0.19578E+01	-0.14462E+00	0.	0.19091E+00	0.10808E+02	0.	0.	-0.42784E+01	0.	0.	0.	0.23975E+00	0.
15	C.	0.20000E+01	0.20000E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.40352E+01	0.	0.	0.	0.24316E+00	0.
16	C.	0.22500E+01	0.20417E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.37818E+01	0.	0.	0.	0.25345E+00	0.
17	C.	0.25000E+01	0.20833E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.35283E+01	0.	0.	0.	0.25345E+00	0.
18	C.	0.27500E+01	0.21250E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.32749E+01	0.	0.	0.	0.25345E+00	0.
19	C.	0.30000E+01	0.21667E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.30214E+01	0.	0.	0.	0.25345E+00	0.
20	C.	0.32500E+01	0.22083E+01	0.	0.	0.16667E+00	0.94623E+01	0.	0.	-0.27680E+01	0.	0.	0.	0.25345E+00	0.
21	C.	0.35000E+01	0.22500E+01	-0.22303E-01	0.	0.16667E+00	0.94623E+01	0.	0.	-0.25145E+01	0.	0.	0.	0.25345E+00	0.
22	C.	0.37498E+01	0.22858E+01	-0.53315E-01	0.	0.15214E+00	0.86504E+01	0.	0.	-0.22616E+01	0.	0.	0.	0.25297E+00	0.
23	C.	0.39986E+01	0.23260E+01	-0.47420E-01	0.	0.13926E+00	0.79282E+01	0.	0.	-0.20101E+01	0.	0.	0.	0.25144E+00	0.
24	C.	0.42482E+01	0.23593E+01	-0.44301E-01	0.	0.12757E+00	0.72658E+01	0.	0.	-0.17584E+01	0.	0.	0.	0.25175E+00	0.
25	C.	0.44982E+01	0.23858E+01	-0.43620E-01	0.	0.11638E+00	0.66381E+01	0.	0.	-0.15065E+01	0.	0.	0.	0.25192E+00	0.
26	C.	0.47487E+01	0.24175E+01	-0.45329E-01	0.	0.10509E+00	0.59515E+01	0.	0.	-0.12545E+01	0.	0.	0.	0.25197E+00	0.
27	C.	0.49939E+01	0.24424E+01	-0.49985E-01	0.	0.93039E-01	0.53154E+01	0.	0.	-0.10626E+01	0.	0.	0.	0.25193E+00	0.
28	C.	0.52501E+01	0.24640E+01	-0.59215E-01	0.	0.79330E-01	0.45352E+01	0.	0.	-0.75091E+00	0.	0.	0.	0.25170E+00	0.
29	C.	0.55008E+01	0.24819E+01	-0.77234E-01	0.	0.62352E-01	0.35679E+01	0.	0.	-0.49961E+00	0.	0.	0.	0.25130E+00	0.
30	C.	0.57510E+01	0.24947E+01	-0.11637E+00	0.	0.38730E-01	0.22179E+01	0.	0.	-0.24908E+00	0.	0.	0.	0.25053E+00	0.
31	C.	0.60000E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.24938E+00	0.
32	C.	0.62541E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.25409E+00	0.
33	C.	0.65500E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.30491E+00	0.
34	C.	0.69245E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.36589E+00	0.
35	C.	0.73640E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.43997E+00	0.
36	C.	0.78908E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.52688E+00	0.
37	C.	0.85231E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.63225E+00	0.
38	C.	0.92818E+01	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.75871E+00	0.
39	C.	1.0192E+02	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.91945E+00	0.
40	C.	1.1094E+02	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.90388E+00	0.
41	C.	1.2000E+02	0.25000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.90388E+00	0.

BODY 2 CO-ORDINATES - X		Y		KAPPA		DY/DX		ALPHA		S		S(2)-S		DELTA	
42	C.	0.12000E+02	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
43	C.	0.11096E+02	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.90388E+00	0.
44	C.	0.10192E+02	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.90388E+00	0.
45	C.	0.92818E+01	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.91045E+00	0.
46	C.	0.85231E+01	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.75871E+00	0.
47	C.	0.78908E+01	0.50000E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.63225E+00	0.



I	XON	YCN	YONH	AREA	DISC AREA
42	1.200CE+01	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
43	1.1096E+01	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
44	1.0192E+01	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
45	9.2818E+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
46	8.5231E+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
47	7.8908E+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
48	7.364CE+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
49	6.9245E+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
50	6.559CE+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
51	6.2541E+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
52	6.000CE+00	5.0000E+00	2.5000E+00	5.8905E+01	7.8540E+01
53	5.750CE+00	5.0000E+00	2.4947E+00	5.8988E+01	7.8540E+01
54	5.500CE+00	5.0000E+00	2.4819E+00	5.9189E+01	7.8540E+01
55	5.250CE+00	5.0000E+00	2.4640E+00	5.9466E+01	7.8540E+01
56	5.000CE+00	5.0000E+00	2.4425E+00	5.9798E+01	7.8540E+01
57	4.7588E+00	5.0092E+00	2.4186E+00	6.3451E+01	7.8828E+01
58	4.5056E+00	5.0363E+00	2.3907E+00	6.1728E+01	7.9683E+01
59	4.2405E+00	5.0759E+00	2.3583E+00	6.3598E+01	8.1070E+01
60	3.564CE+00	5.1377E+00	2.3212E+00	6.600CE+01	8.2926E+01

61	3.6776E+00	5.2058E+00	2.2786E+00	6.8827E+01	8.5139E+01
62	3.3835E+00	5.2790E+00	2.2309E+00	7.1913E+01	8.7548E+01
63	3.0891E+00	5.3502E+00	2.1815E+00	7.4975E+01	8.9925E+01
64	2.8011E+00	5.4121E+00	2.1335E+00	7.7719E+01	9.2019E+01
65	2.5225E+00	5.4597E+00	2.0872E+00	7.9961E+01	9.3646E+01
66	2.2565E+00	5.4897E+00	2.0427E+00	8.1567E+01	9.4676E+01
67	2.0006E+00	5.5000E+00	2.0000E+00	8.2467E+01	9.5033E+01
68	1.7735E+00	5.5009E+00	1.9602E+00	8.2995E+01	9.5066E+01
69	1.5725E+00	5.5063E+00	1.9187E+00	8.3686E+01	9.5252E+01
70	1.3793E+00	5.5195E+00	1.8709E+00	8.4710E+01	9.5737E+01
71	1.1945E+00	5.5426E+00	1.8160E+00	8.6151E+01	9.6511E+01
72	1.0190E+00	5.5776E+00	1.7533E+00	8.8077E+01	9.7734E+01
73	8.5150E-01	5.6260E+00	1.6818E+00	9.0551E+01	9.9436E+01
74	6.9453E-01	5.6822E+00	1.6005E+00	9.3597E+01	1.0165E+02
75	5.4735E-01	5.7658E+00	1.5093E+00	9.7285E+01	1.0444E+02
76	4.1482E-01	5.8570E+00	1.4087E+00	1.0154E+02	1.0777E+02
77	2.9653E-01	5.9627E+00	1.2978E+00	1.0641E+02	1.1173E+02
78	1.9494E-01	6.0819E+00	1.1748E+00	1.1187E+02	1.1621E+02
79	1.1248E-01	6.2128E+00	1.0367E+00	1.1789E+02	1.2126E+02
80	5.1336E-02	6.3532E+00	8.8358E-01	1.2435E+02	1.2680E+02

E1	1.3387E-02	6.5000E+00	7.0709E-01	1.3116E+02	1.3273E+02
E2	0.	6.6500E+00	0.	1.3893E+02	1.3893E+02
E3	0.	6.8326E+00	0.	1.4666E+02	1.4666E+02
E4	0.	7.0517E+00	0.	1.5622E+02	1.5622E+02
E5	0.	7.3146E+00	0.	1.6809E+02	1.6809E+02
E6	0.	7.6301E+00	0.	1.8290E+02	1.8290E+02
E7	0.	8.0087E+00	0.	2.0150E+02	2.0150E+02
E8	0.	8.4631E+00	0.	2.2501E+02	2.2501E+02
E9	0.	9.0083E+00	0.	2.5494E+02	2.5494E+02
E0	0.	9.6625E+00	0.	2.9331E+02	2.9331E+02
E1	0.	1.0448E+01	0.	3.4291E+02	3.4291E+02
E2	0.	1.1350E+01	0.	4.0754E+02	4.0754E+02
E3	0.	1.2346E+01	0.	4.7888E+02	4.7888E+02
E4	0.	1.3303E+01	0.	5.5597E+02	5.5597E+02
E5	0.	1.4260E+01	0.	6.3882E+02	6.3882E+02
E6	0.	1.5216E+01	0.	7.2741E+02	7.2741E+02
E7	0.	1.6173E+01	0.	8.2175E+02	8.2175E+02
E8	0.	1.7130E+01	0.	9.2185E+02	9.2185E+02
E9	0.	1.8087E+01	0.	1.0277E+03	1.0277E+03
100	0.	1.9043E+01	0.	1.1393E+03	1.1393E+03
101	0.	2.0000E+01	0.	1.2566E+03	1.2566E+03

REC= 00000 F11= 00002

\*C1\* UNITS, ECF.



EOD

DOUGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

PROGRAM EODA -- AXISYMMETRIC AND CROSSEFLOW

\*\*\*\*\* CASE CONTROL DATA \*\*\*\*\*

TEST CASE

BCCIES = 3  
NNU = -0  
CHGRD = 1.000000  
MACH NO. = -0.  
TCNST = -0.

3-BODY CASE NO. TEST

SURFACE OF REVOLUTION

CROSSEFLOW

OFF-BODY POINTS

MATRIX SOLUTION BY TRIANGULARIZATION (SOLVIT)

INPUT TAPE NO. FOR COORDINATES AND NON-UNIFORM FLOW ONLY = 5

DCLGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

3-BODY

TEST CASE

AN = 41  
THETA = -0.  
XE = -0.

MX = -0.  
ADCX = -0.  
YE = -0.

MY = -0.  
ADDY = -0.

GN-BODY COORDINATES (UNTRANSFORMED)

BODY NC. 1

	X	Y	DELTA S	SUMDS	D ALPHA
1	0.	0.	0.2500000	0.2500000	U.
2	0.	0.1250000	0.2500000	0.5000000	-3.8241162
3	-0.	0.2500000	0.2500000	0.7512674	-11.7650077
4	-0.	0.3750000	0.2512674	0.9698752	-12.6493235
5	0.0083790	0.6253540	0.2186078	1.1862373	-11.3918442
6	0.0167580	0.7507080	0.2163621	1.4037901	-9.4025823
7	0.0461320	0.8555910	0.2175528	1.6244419	-7.4792177
8	0.0755060	0.9612740	0.2206517	1.8417099	-6.0293090
9	0.126910	1.0565800	0.2241126	2.0658224	-5.0261505
10	0.2472570	1.1518860	0.2293564	2.2951787	-4.2010204
11	0.3166380	1.2356630	0.2367476	2.5286056	-3.4872889
12	0.3999435	1.3917725	0.2397538	3.0051070	-2.7941246
13	0.4832490	1.4641050	0.2431590	3.2482660	-1.9488477
14	0.5738500	1.5240450	0.2534485	4.0086113	-0.5387681
15	0.6644510	1.5839850	0.2534485	4.2620597	-0.0032325
16	0.7638835	1.6356550	0.2534485	4.5155081	U.
17	0.8633160	1.6873250	0.2534485	4.7689565	-0.0032325
18	0.9693165	1.7310855	0.2534485	5.0219238	-0.4091516
19	1.0753170	1.7748460	0.2529673	5.2733631	-0.7711682
20	1.1861715	1.8113605	0.2514393		-0.6866971
21	1.2970260	1.8478750			
22	1.4115020	1.8780015			
23	1.5259780	1.9081280			
	1.6432570	1.9325495			
	1.7605360	1.9577710			
	1.8802480	1.9788855			
	2.0000000	2.0000000			
	2.1250000	2.0208335			
	2.2500000	2.0416670			
	2.3750000	2.0625000			
	2.5000000	2.0833330			
	2.6250000	2.1041665			
	2.7500000	2.1250000			
	2.8750000	2.1458335			
	3.0000000	2.1666670			
	3.1250000	2.1875000			
	3.2500000	2.2083330			
	3.3750000	2.2291665			
	3.5000000	2.2500000			
	3.6249080	2.2659025			
	3.7498160	2.2898050			
	3.8742245	2.3079145			
	3.9986330	2.3260240			

24	4.1234019	2.3426615	0.2517468	5.5251098	-0.6423096
	4.2481710	2.3592990			
	4.3732024	2.3745478	0.2519157	5.7770255	-0.6325730
25	4.4982340	2.3897950			
	4.6234515	2.4036645	0.2519666	6.0289921	-0.6577064
26	4.7486690	2.4175340			
	4.8740050	2.4295620	0.2519013	6.2808933	-0.7263850
27	4.9993410	2.4423900			
	5.1247255	2.4532195	0.2517026	6.5325959	-0.8634634
28	5.2501100	2.4640490			
	5.3754430	2.4725735	0.2513007	6.7838966	-1.1340381
29	5.5007760	2.4818980			
	5.6258765	2.4883205	0.2505305	7.0344270	-1.7295423
30	5.7509770	2.4947430			
	5.8754885	2.4973715	0.2490785	7.2835055	-1.2093652
31	6.0000000	2.5000000			
	6.1270445	2.5000000	0.2540890	7.5375945	0.
32	6.2540890	2.5000000			
	6.4065425	2.5000000	0.3049070	7.8425015	0.
33	6.5589960	2.5000000			
	6.7419400	2.5000000	0.3658880	8.2083895	0.
34	6.9248840	2.5000000			
	7.1444170	2.5000000	0.4390660	8.6474555	0.
35	7.3639500	2.5000000			
	7.6273895	2.5000000	0.5268790	9.1743344	0.
36	7.8908290	2.5000000			
	8.2069565	2.5000000	0.6322550	9.8065894	0.
37	8.5230840	2.5000000			
	8.9024370	2.5000000	0.7587060	10.5652952	0.
38	9.2817900	2.5000000			
	9.7370135	2.5000000	0.9104470	11.4757422	0.
39	10.1922370	2.5000000			
	10.6441774	2.5000000	0.9038810	12.3796232	0.
40	11.0961180	2.5000000			
	11.5480590	2.5000000	0.9038820	13.2835052	0.
41	12.0000000	2.5000000			

DUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

3-BODY

TEST CASE

NN = 60  
THETA = -0.  
XE = -0.  
PX = -0.  
ACDX = -0.  
YE = -0.  
MY = -0.  
ADDY = -0.

CN-BODY COORDINATES (UNTRANSFORMED)

BCDY NC. 2

	X	Y	DELTA S	SUMDS	D ALPHA
1	12.0000000	5.0000000	0.9038820	0.9038820	0.
2	11.5480590	5.0000000	0.9038810	1.8077630	0.
3	11.0961180	5.0000000	0.9104470	2.7182100	0.
4	10.6441774	5.0000000	0.7587060	3.4769159	0.
5	10.1922370	5.0000000	0.6322550	4.1091709	0.
6	9.7370135	5.0000000	0.5268790	4.6360499	0.
7	9.2817900	5.0000000	0.4390660	5.0751159	0.
8	8.9024370	5.0000000	0.3658880	5.4410039	0.
9	8.5230840	5.0000000	0.3049070	5.7459109	0.
10	8.2069565	5.0000000	0.2540890	5.9999999	0.
11	7.8908290	5.0000000	0.2500000	6.2499999	0.
12	7.6273895	5.0000000	0.2500000	6.4999999	0.
13	7.3639500	5.0000000	0.2500000	6.7499999	0.
14	7.1444170	5.0000000	0.2500000	6.9999999	-2.1792316
15	6.9248840	5.0000000	0.2414166	7.2414165	-3.9268209
16	6.7419400	5.0000000	0.2545572	7.4959737	-3.2439557
17	6.5589960	5.0000000	0.2687100	7.7646837	-2.4545241
18	6.4065425	5.0000000	0.2825291	8.0472127	-1.5724325
19	6.2540890	5.0000000	0.2943809	8.3415935	-0.6106070
20	6.1270445	5.0000000	0.3026377	8.6442312	0.4115753
21	6.0000000	5.0000000	0.3032613	8.9474925	1.4410384
22	5.8750000	5.0000000	0.2945650	9.2420574	2.4166217
23	5.7500000	5.0000000			
24	5.6250000	5.0000000			
25	5.5000000	5.0000000			
26	5.3750000	5.0000000			
27	5.2500000	5.0000000			
28	5.1250000	5.0000000			
29	5.0000000	5.0000000			
30	4.8750000	5.0000000			
31	4.7500000	5.0000000			
32	4.6250000	5.0000000			
33	4.5000000	5.0000000			
34	4.3750000	5.0000000			
35	4.2500000	5.0000000			
36	4.1250000	5.0000000			
37	4.0000000	5.0000000			
38	3.8750000	5.0000000			
39	3.7500000	5.0000000			
40	3.6250000	5.0000000			
41	3.5000000	5.0000000			
42	3.3750000	5.0000000			
43	3.2500000	5.0000000			
44	3.1250000	5.0000000			
45	3.0000000	5.0000000			
46	2.8750000	5.0000000			
47	2.7500000	5.0000000			
48	2.6250000	5.0000000			
49	2.5000000	5.0000000			
50	2.3750000	5.0000000			
51	2.2500000	5.0000000			
52	2.1250000	5.0000000			
53	2.0000000	5.0000000			
54	1.8750000	5.0000000			
55	1.7500000	5.0000000			
56	1.6250000	5.0000000			
57	1.5000000	5.0000000			
58	1.3750000	5.0000000			
59	1.2500000	5.0000000			
60	1.1250000	5.0000000			
61	1.0000000	5.0000000			
62	0.8750000	5.0000000			
63	0.7500000	5.0000000			
64	0.6250000	5.0000000			
65	0.5000000	5.0000000			
66	0.3750000	5.0000000			
67	0.2500000	5.0000000			
68	0.1250000	5.0000000			
69	0.0000000	5.0000000			

24	2.6620285	5.4358985	0.2822372	9.5242946	3.3069454
	2.5229350	5.4597200			
25	2.3897135	5.4746900	0.2681199	9.7924144	4.1028724
	2.2564920	5.4896600			
26	2.1282460	5.4948300	0.2567003	10.0491147	2.0705958
	2.0000000	5.5000000			
27	1.8869355	5.5004695	0.2261309	10.2752455	-1.2980553
	1.7738710	5.5009390			
28	1.6733840	5.5036335	0.2010462	10.4762918	-2.3423041
	1.5728970	5.5063280			
29	1.4761160	5.5128890	0.1940063	10.6702980	-3.2782757
	1.3793350	5.5194500			
30	1.2870955	5.5310315	0.1859275	10.8562254	-4.0991654
	1.1948560	5.5426130			
31	1.1069210	5.5601135	0.1793191	11.0355444	-4.8494838
	1.0189860	5.5776140			
32	0.9352410	5.6017940	0.1743318	11.2098762	-5.5262105
	0.8514960	5.6255740			
33	0.6945320	5.6570970	0.1688557	11.3787318	-6.1684719
	0.6209400	5.6882200			
34	0.5473480	5.7270205	0.1663882	11.5451200	-6.7392436
	0.4810835	5.7658210			
35	0.4148190	5.8114300	0.1608871	11.7060070	-7.2455193
	0.3556720	5.8570390			
36	0.2965250	5.9098940	0.1586445	11.8646514	-7.7658312
	0.2457330	5.9627490			
37	0.1949410	6.0223250	0.1565775	12.0212289	-8.2404850
	0.1537080	6.0815010			
38	0.1124750	6.1473550	0.1547176	12.1759465	-8.6697624
	0.0819055	6.2128090			
39	0.0513360	6.2829825	0.1530857	12.3290322	-9.0519558
	0.0323615	6.3531560			
40	0.0133870	6.4265920	0.1516955	12.4807277	-9.3864200
	0.0066935	6.5000280			
41	0.0000000	6.5750140	0.1505683	12.6312959	-5.1008937
	0.0000000	6.6500000			
42	0.0000000	6.7412925	0.1825850	12.8138809	0.0000000
	0.0000000	6.8325850			
43	0.0000000	6.9421365	0.2191030	13.0329839	0.0000000
	0.0000000	7.0516880			
44	0.0000000	7.1831495	0.2629230	13.2959069	0.0000000
	0.0000000	7.3146110			
45	0.0000000	7.4722650	0.3155080	13.6114149	0.0000000
	0.0000000	7.6301150			
46	0.0000000	7.8194235	0.3786090	13.9900239	0.0000000
	0.0000000	8.0087280			
47	0.0000000	8.2358935	0.4543309	14.4443548	0.0000000
	0.0000000	8.4630589			
48	0.0000000	8.7356575	0.5451970	14.9895518	0.0000000
	0.0000000	9.0082560			
49	0.0000000	9.3333745	0.6542370	15.6437888	0.0000000
	0.0000000	9.6624930			
50	0.0000000	10.0550350	0.7850840	16.4288726	0.0000000
	0.0000000	10.4475770			
51	0.0000000	10.9186275	0.9421010	17.3709736	0.0000000
	0.0000000	11.3896780			
52	0.0000000	11.8680295	0.9567029	18.3276765	0.0000000
	0.0000000	12.3463809			
53	0.0000000	12.8247315	0.9567020	19.2843785	0.0000000
	0.0000000	13.3030829			

54	0.	13.7814339	0.9567021	20.2410805	0.
	0.	14.2597851			
55	0.	14.7381365	0.9567029	21.1977835	0.
	0.	15.2164880			
56	0.	15.6948390	0.9567021	22.1544855	0.
	0.	16.1731901			
57	0.	16.6515410	0.9567020	23.11111875	0.
	0.	17.1298921			
58	0.	17.6082430	0.9567020	24.0678895	0.
	0.	18.0865941			
59	0.	18.5645455	0.9567029	25.0245924	0.
	0.	19.0432971			
60	0.	19.5216484	0.9567029	25.9812953	
	0.	20.0000000			

DOUGLAS AIRCRAFT COMPANY  
 LCNG BEACH DIVISION

TEST CASE 3-BODY

AN = 4      MX = -0.      MY = -0.  
 THETA = -0.      ACX = -0.      ADDY = -0.  
 XE = -0.      YE = -0.

CN-BODY COORDINATES (UNTRANSFORMED)

BCDY NC. 3

	X	Y	DELTA S	SUMDS	D ALPHA
1	12.0000000	2.5000000			
	12.0000000	2.9166665	0.8333330	0.8333330	
2	12.0000000	3.3333330			0.
	12.0000000	3.7500000	0.8333340	1.6666670	
3	12.0000000	4.1666670			0.
	12.0000000	4.5833335	0.8333330	2.5000000	
4	12.0000000	5.0000000			

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

TEST CASE

3-BODY

NN = 24  
THETA = -0.  
XE = -0.  
MX = -0.  
ADXX = -0.  
YE = -0.

MY = -0.  
ADDY = -0.

CFF-BCDY COORDINATES (UNTRANSFORMED)

	X-OFF	Y-OFF
1	2.0000000	2.5000000
2	2.0000000	3.0000000
3	2.0000000	3.5000000
4	2.0000000	4.0000000
5	2.0000000	4.5000000
6	2.0000000	5.0000000
7	4.0000000	2.7500000
8	4.0000000	3.0000000
9	4.0000000	3.2500000
10	4.0000000	3.5000000
11	4.0000000	3.7500000
12	4.0000000	4.0000000
13	4.0000000	4.2500000
14	4.0000000	4.5000000
15	4.0000000	4.7500000
16	6.0000000	2.7500000
17	6.0000000	3.0000000
18	6.0000000	3.2500000
19	6.0000000	3.5000000
20	6.0000000	3.7500000
21	6.0000000	4.0000000
22	6.0000000	4.2500000
23	6.0000000	4.5000000
24	6.0000000	4.7500000

THE 102 X 102 MATRIX WITH 1 RIGHT SIDES WAS SOLVED DIRECTLY IN 0.005 MINUTES.

THE 102 X 102 MATRIX WITH 1 RIGHT SIDES WAS SOLVED DIRECTLY IN 0.005 MINUTES.



DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

TEST CASE 3-BODY CASE NO. TEST

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	TI	CP	SIN A	COS A	SIGMA	N	PHI
1	0.	0.	0.0131311	0.9998276	1.00000	0.	-0.0342820	-0.0000001	-19.9221981
2	0.	0.1250000	0.0396814	0.9984254	1.00030	-0.	-0.0333696	-0.0000001	-19.9153388
3	-0.	0.3750000	0.0869950	0.9934398	0.99777	0.06669	-0.0310698	-0.0000000	-19.9078133
4	0.0083790	0.6252540	0.1436507	0.9793645	0.96321	0.26874	-0.0267064	-0.0000000	-19.9178820
5	0.0167580	0.8555910	0.1942429	0.9622697	0.88099	0.47314	-0.0224692	-0.0000001	-19.9603941
6	0.0755060	0.9612740	0.2310025	0.9466379	0.77018	0.63783	-0.0184587	-0.0000001	-20.0335832
7	0.1266910	1.0565800	0.2548887	0.9350317	0.65563	0.75509	-0.0150457	-0.0000001	-20.1319773
8	0.1778760	1.1518860	0.2698558	0.9271778	0.55176	0.83400	-0.0122794	-0.0000001	-20.2476029
9	0.2472570	1.2356630	0.2789624	0.9221800	0.46111	0.88734	-0.0100747	-0.0000001	-20.3764017
10	0.3166380	1.3154400	0.2848752	0.9188461	0.38139	0.92433	-0.0082269	-0.0000000	-20.5173342
11	0.3999435	1.3917725	0.2884461	0.9167988	0.31286	0.94980	-0.0066774	-0.0000001	-20.6673591
12	0.4832490	1.4641050	0.2901116	0.9158353	0.25450	0.96707	-0.0053966	-0.0000000	-20.8242595
13	0.5738500	1.5240450	0.2899924	0.9159044	0.20706	0.97833	-0.0044130	-0.0000000	-20.9865668
14	0.6644510	1.5835850	0.2882581	0.9169073	0.17367	0.98480	-0.0038844	-0.0000000	-21.1535707
15	0.7638835	1.6356550	0.2871253	0.9175591	0.16440	0.98639	-0.0042788	-0.0000000	-21.3270819
16	0.8633160	1.6873250	0.2889896	0.9164850	0.16440	0.98639	-0.0049329	-0.0000000	-21.5043774
17	0.9693165	1.7310855	0.2932947	0.9139782	0.16440	0.98639	-0.0054755	-0.0000000	-21.6808147
18	1.0753170	1.7748460	0.2990876	0.9105466	0.16440	0.98639	-0.0059514	-0.0000000	-21.8559356
19	1.1861715	1.8113605	0.3061728	0.9062582	0.16440	0.98639	-0.0063818	-0.0000000	-22.0294168
20	1.2970260	1.8478750	0.3148567	0.9008653	0.16440	0.98639	-0.0067743	-0.0000000	-22.2009008
21	1.4115020	1.8780015	0.3248776	0.8944546	0.15735	0.98754	-0.0067836	-0.0000000	-22.3698225
22	1.5259780	1.9081280	0.3345165	0.8880987	0.14405	0.98957	-0.0064461	-0.0000000	-22.5358374

3-BODY CASE NO. TEST

TEST CASE

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	T1	CP	SIN A	COS A	SIGMA	N	PHI
23	3.9986330	2.3260240							
24	4.1234019	2.3426615	0.3431688	0.8822351	0.13218	0.99123	-0.0061479	-0.0000000	-22.6996534
25	4.2481710	2.3552590	0.3514930	0.8764527	0.12106	0.99265	-0.0058415	-0.0000000	-22.8618746
26	4.3732024	2.3745470	0.3595760	0.8707051	0.11009	0.99392	-0.0054958	-0.0000000	-23.0224252
27	4.4982340	2.4036645	0.3673881	0.8650260	0.09867	0.99512	-0.0050836	-0.0000000	-23.1812561
28	4.6234515	2.4175340	0.3748600	0.8594799	0.08605	0.99629	-0.0045707	-0.0000000	-23.3383412
29	4.7486690	2.4299620	0.3818584	0.8541842	0.07103	0.99747	-0.0038981	-0.0000000	-23.4936559
30	4.8740050	2.4423900	0.3879084	0.8495270	0.05127	0.99868	-0.0029364	-0.0000000	-23.6471574
31	5.0077160	2.4532195	0.3901714	0.8477663	0.02111	0.99978	-0.0013439	-0.0000000	-23.7988913
32	5.1247255	2.4640490	0.3870687	0.8501778	0.	1.00000	-0.0002873	-0.0000000	-23.9522195
33	5.2501100	2.4729735	0.3836582	0.8528064	0.	1.00000	-0.0004877	-0.0000000	-24.1241920
34	5.3754430	2.4818980	0.3825168	0.8536809	0.	1.00000	-0.0007144	-0.0000000	-24.3312447
35	5.5007760	2.4947430	0.3822255	0.8539037	0.	1.00000	-0.0010486	-0.0000000	-24.5800261
36	5.6258765	2.5000000	0.3823803	0.8537853	0.	1.00000	-0.0016351	0.0000000	-24.8787391
37	5.7509770	2.5000000	0.3827307	0.8535172	0.	1.00000	-0.0028104	-0.0000000	-25.2374685
38	5.8754885	2.5000000	0.3829474	0.8533513	0.	1.00000	-0.0055094	-0.0000000	-25.6690440
39	6.0000000	2.5000000	0.3849852	0.8517864	0.	1.00000	-0.0129652	-0.0000000	-26.1911981
40	6.1270445	2.5000000	0.3984247	0.8412577	0.	1.00000	-0.0361597	-0.0000001	-26.7731020
41	6.2540890	2.5000000	0.8433571	0.2887488	0.	1.00000	-0.1301989	-0.0000004	-27.3090472
42	6.405425	2.5000000							
43	6.5589960	2.5000000	-1.4339074	-1.0560904	0.	-1.00000	-0.4456426	-0.0000006	-26.9859664
44	6.7419400	2.5000000	-0.5730430	0.6716217	0.	-1.00000	-0.3023874	-0.0000003	-26.6804409
45	6.9248840	2.5000000	-0.4676190	0.7813325	0.	-1.00000	-0.2453889	-0.0000002	-26.1649947
46	7.1444170	2.5000000							
47	7.3639500	2.5000000							
48	7.6273895	2.5000000							
49	7.8908290	2.5000000							
50	8.2069565	2.5000000							
51	8.5230840	2.5000000							
52	8.9024370	2.5000000							
53	9.2817900	2.5000000							
54	9.7370135	2.5000000							
55	10.1922370	2.5000000							
56	10.6441774	2.5000000							
57	11.0961180	2.5000000							
58	11.5480590	2.5000000							
59	12.0000000	2.5000000							
60	12.0000000	5.0000000							
61	11.5480590	5.0000000							
62	11.0961180	5.0000000							
63	10.6441774	5.0000000							
64	10.1922370	5.0000000							
65	9.7370135	5.0000000							

3-BODY CASE NO. TEST

TEST CASE

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	T1	CP	SIN A	COS A	SIGMA	N	PHI
45	9.2817900	5.0000000	-0.4248608	0.8194933	0.	-1.00000	-0.2122278	-0.0000002	-25.6633532
46	8.9024370	5.0000000	-0.4089034	0.8327980	0.	-1.00000	-0.1906611	-0.0000002	-25.2371342
47	8.2069565	5.0000000	-0.4006856	0.8394510	0.	-1.00000	-0.1750244	-0.0000001	-24.8797667
48	7.6273895	5.0000000	-0.3956957	0.8434249	0.	-1.00000	-0.1630011	-0.0000001	-24.5811722
49	7.1444170	5.0000000	-0.3923964	0.8460251	0.	-1.00000	-0.1534174	-0.0000001	-24.3320181
50	6.7419400	5.0000000	-0.3901432	0.8477883	0.	-1.00000	-0.1455890	-0.0000001	-24.1242630
51	6.5589960	5.0000000	-0.3884452	0.8491103	0.	-1.00000	-0.1390766	-0.0000001	-23.9510939
52	6.4065425	5.0000000	-0.3899826	0.8479136	0.	-1.00000	-0.1331225	-0.0000001	-23.7950759
53	6.1270445	5.0000000	-0.3924860	0.8459547	0.	-1.00000	-0.1270145	-0.0000001	-23.6407433
54	5.8750000	5.0000000	-0.3974568	0.8420281	0.	-1.00000	-0.1204525	-0.0000000	-23.4871421
55	5.6250000	5.0000000	-0.4129395	0.8294809	0.	-1.00000	-0.1125981	-0.0000000	-23.3353105
56	5.3750000	5.0000000	-0.4158710	0.8270513	0.03803	-0.99928	-0.1071958	-0.0000001	-23.1894159
57	5.1250000	5.0000000	-0.3998640	0.8401088	0.10637	-0.99433	-0.1067106	-0.0000000	-23.0433102
58	4.8793790	5.0000000	-0.3795565	0.8559369	0.16247	-0.98671	-0.1078417	-0.0000000	-22.8867433
59	4.6322015	5.0227185	-0.3555353	0.8735947	0.20457	-0.97885	-0.1090011	-0.0000001	-22.7178323
60	4.5036450	5.0362570	-0.3306140	0.8906944	0.23136	-0.97287	-0.1094069	-0.0000001	-22.5356865
61	4.3730749	5.0580850	-0.3073139	0.9055582	0.24171	-0.97035	-0.1084799	-0.0000001	-22.3407023
62	4.2405050	5.0795130	-0.2877171	0.9172188	0.23473	-0.97206	-0.1057404	-0.0000001	-22.1356509
63	4.1022280	5.1088120	-0.2732043	0.9253594	0.21022	-0.97766	-0.1008595	-0.0000000	-21.9261956
64	3.9639510	5.1377110	-0.2648462	0.9298565	0.16880	-0.98565	-0.0936006	-0.0000000	-21.7178130
65	3.8207540	5.1717645	-0.2638481	0.9303842	0.11167	-0.99375	-0.0837641	-0.0000000	-21.5143833
66	3.6775570	5.2058180	-0.2769832	0.9232803	0.04028	-0.99919	-0.0708376	0.0000000	-21.3187256

## 3-BODY CASE NO. TEST

## TEST CASE

GN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	T1	CP	SIN A	COS A	SIGMA	N	PHI
67	2.0000000	5.5000000	-0.2884185	0.9168148	0.00415	-0.99999	-0.0585021	0.0000001	-21.1409991
68	1.8869355	5.5004695	-0.2933960	0.9139188	0.02680	-0.99964	-0.0505095	0.0000000	-20.9871237
69	1.7738710	5.5009390	-0.2992317	0.9104604	0.06764	-0.99771	-0.0453209	0.0000001	-20.8469472
70	1.6733840	5.5063335	-0.3014130	0.9091502	0.12458	-0.99221	-0.0419254	0.0000000	-20.7140911
71	1.5728970	5.5128890	-0.2991797	0.9104915	0.19519	-0.98077	-0.0399776	0.0000000	-20.5882916
72	1.4761160	5.5194500	-0.2914714	0.9150444	0.27740	-0.96075	-0.0391646	-0.0000000	-20.4686667
73	1.3793350	5.5310315	-0.2775320	0.9229760	0.36863	-0.92957	-0.0391932	0.0000000	-20.3553135
74	1.2870955	5.5426130	-0.2567207	0.9340945	0.46638	-0.88458	-0.0398612	-0.0000001	-20.2482080
75	1.1948560	5.5601135	-0.2291283	0.9475002	0.56697	-0.82374	-0.0408578	-0.0000001	-20.1483808
76	1.1069210	5.5776140	-0.1952145	0.9618913	0.66633	-0.74565	-0.0420641	-0.0000001	-20.0571594
77	1.0189860	5.6017940	-0.1555722	0.9757973	0.76098	-0.64878	-0.0432812	-0.0000001	-19.9751430
78	0.9352410	5.6259740	-0.1117835	0.9875044	0.84611	-0.53301	-0.0444124	-0.0000001	-19.9041631
79	0.8514960	5.6570970	-0.0659875	0.9956456	0.91679	-0.39938	-0.0454803	-0.0000001	-19.8462351
80	0.7730140	5.6822000	-0.0206061	0.9995754	0.96820	-0.25017	-0.0467678	-0.0000001	-19.8035123
81	0.6945320	5.7270205	0.0253722	0.9993562	0.99604	-0.08891	-0.0494296	-0.0000001	-19.7780633
82	0.6209400	5.7658210	0.0584650	0.9965818	1.00000	0.	-0.0550653	-0.0000000	-19.7656555
83	0.5473480	5.8114300	0.0726749	0.9947184	1.00000	0.	-0.0617072	-0.0000000	-19.7544489
84	0.4810835	5.8570390	0.0921014	0.9915173	1.00000	0.	-0.0675260	-0.0000000	-19.7364702
85	0.4148190	5.9098940	0.1127936	0.9872776	1.00000	0.	-0.0733233	-0.0000000	-19.7090740
86	0.3566720	5.9627490	0.1346782	0.9818618	1.00000	0.	-0.0793238	-0.0000000	-19.6689107
87	0.2965250	6.0223250	0.1580671	0.9750148	1.00000	0.	-0.0856098	-0.0000000	-19.6114573
88	0.2457330	6.0819010	0.1834670	0.9663399	1.00000	0.	-0.0921941	0.	-19.5305371

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

TEST CASE

3-BODY CASE NO. TEST

CN-8CCY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	TI	CP	SIN A	COS A	SIGMA	N	PHI
89	0.	9.0082560	0.2116146	0.9552192	1.00000	0.	-0.0990431	-0.0000000	-19.4176202
90	0.	9.3353745	0.2436064	0.9406559	1.00000	0.	-0.1060840	-0.0000000	-19.2607155
91	0.	10.0550350	0.2813443	0.9208454	1.00000	0.	-0.1132069	0.0000000	-19.0425532
92	0.	10.9186275	0.3204983	0.8972809	1.00000	0.	-0.1197264	0.0000000	-18.7656510
93	0.	11.3896780	0.3626853	0.8684594	1.00000	0.	-0.1251944	0.	-18.4463592
94	0.	12.3463809	0.4090451	0.8326821	1.00000	0.	-0.1297728	0.0000000	-18.0836513
95	0.	13.7814339	0.4614128	0.7870982	1.00000	0.	-0.1336261	0.0000000	-17.6729352
96	0.	14.2597851	0.5226561	0.7268306	1.00000	0.	-0.1368830	0.0000000	-17.2073767
97	0.	15.2164880	0.5977251	0.6427247	1.00000	0.	-0.1396468	0.0000000	-16.6764889
98	0.	16.6515410	0.6965811	0.5147747	1.00000	0.	-0.1420009	0.0000001	-16.0630064
99	0.	17.6082430	0.8450034	0.2859693	1.00000	0.	-0.1440136	0.0000000	-15.3341706
100	0.	18.0865541	1.1631805	-0.3529889	1.00000	0.	-0.1457406	0.0000000	-14.4032063
101	0.	19.0432971							
		20.0000000							
102	12.0000000	2.5000000							
103	12.0000000	2.9166665	-0.4855867	0.7642056	1.00000	0.	-0.3836764	0.0000000	-27.7096057
104	12.0000000	3.3333330	0.2290280	0.9475462	1.00000	0.	-0.3935302	0.0000002	-27.7708983
105	12.0000000	3.7500000	1.3318560	-0.7738403	1.00000	0.	-0.5074222	0.0000007	-27.3689723
106	12.0000000	4.1666670							
107	12.0000000	4.5833335							
108	12.0000000	5.0000000							

ADDED MASS = 2713.9387207 VOLUME = -811.6679382 SUM (TI)(DELTA S) = 6.2187432

DOUGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

TEST CASE 3-800Y CASE NO. TEST

OFF-BCCY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	VX	VY	VT	THETA	PHI
1	2.000000	2.500000	0.2783720	0.0336532	0.2803988	6.8932023	-21.2176995
2	2.000000	3.000000	0.2754318	0.0177211	0.2760013	3.6812993	-21.2049010
3	2.000000	3.500000	0.2730569	0.0034169	0.2730783	0.7169349	-21.1996984
4	2.000000	4.000000	0.2708232	-0.0086427	0.2709610	-1.8278427	-21.2011127
5	2.000000	4.500000	0.2688064	-0.0172767	0.2693611	-3.6774445	-21.2077827
6	2.000000	5.000000	0.2672812	-0.0188682	0.2679464	-4.0379831	-21.2172489
7	4.000000	2.750000	0.3352026	0.0256516	0.3361827	4.3760748	-22.6035929
8	4.000000	3.000000	0.3350338	0.0153103	0.3353835	2.6164717	-22.5984983
9	4.000000	3.250000	0.3350651	0.0059770	0.3351184	1.0219521	-22.5958533
10	4.000000	3.500000	0.3353166	-0.0027746	0.3353280	-0.4740918	-22.5954611
11	4.000000	3.750000	0.3358158	-0.0113375	0.3360071	-1.9336242	-22.5972252
12	4.000000	4.000000	0.3365780	-0.0201211	0.3371789	-3.4211542	-22.6011481
13	4.000000	4.250000	0.3375773	-0.0296086	0.3388733	-5.0125377	-22.6073432
14	4.000000	4.500000	0.3386874	-0.0404200	0.3410908	-6.8056579	-22.6160617
15	4.000000	4.750000	0.3395517	-0.0533587	0.3437186	-8.9306852	-22.6277306
16	6.000000	2.750000	0.3845217	0.0052223	0.3845571	0.7780958	-23.8734667
17	6.000000	3.000000	0.3812172	0.0043775	0.3812424	0.6578988	-23.8722413
18	6.000000	3.250000	0.3794156	0.0028392	0.3794262	0.4287352	-23.8713326
19	6.000000	3.500000	0.3786132	0.0012065	0.3786151	0.1825759	-23.8708274
20	6.000000	3.750000	0.3785338	-0.0002416	0.3785338	-0.0365754	-23.8707125
21	6.000000	4.000000	0.3789717	-0.0013260	0.3789741	-0.2004746	-23.8709183
22	6.000000	4.250000	0.3797150	-0.0019088	0.3797198	-0.2880234	-23.8713338
23	6.000000	4.500000	0.3804967	-0.0018985	0.3805015	-0.2858757	-23.8718228
24	6.000000	4.750000	0.3809523	-0.0012780	0.3809544	-0.1922116	-23.8722317

DOUGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

3-BODY CASE NO. TEST

TEST CASE

CN-BODY UNIFORM CROSS FLOW  
TRANSFORMED COORDINATES

	X	Y	T2	T3	SIN A	COS A	SIGMA	N	PHI
1	0.	0.	0.8839548	0.8798248	1.00000	0.	-0.0013069	-0.0000000	-0.0150219
2	0.	0.1250000	0.9093438	0.8861830	1.00000	-0.	-0.0044923	-0.0000000	-0.0426814
3	-0.	0.2500000	0.9545615	0.9066597	0.99777	0.06669	-0.0001076	0.0000000	-0.0583707
4	0.0083790	0.6253540	0.9528734	0.9343072	0.96321	0.26874	0.0219439	0.0000001	-0.0562325
5	0.0167580	0.7507080	0.8496185	0.9492967	0.88099	0.47314	0.0434816	0.0000002	-0.0535721
6	0.0461320	0.8555910	0.6925106	0.9509996	0.77018	0.63783	0.0590396	0.0000002	-0.0605480
7	0.0755060	0.9612740	0.5244932	0.9419854	0.65563	0.75509	0.0682725	0.0000002	-0.0807431
8	0.1266910	1.0565800	0.3717635	0.9253253	0.55176	0.83400	0.0726383	0.0000003	-0.1138076
9	0.1778760	1.1518860	0.2396997	0.9034732	0.46111	0.88734	0.0740767	0.0000002	-0.1578846
10	0.2472570	1.2356630	0.1273974	0.8773892	0.38159	0.92433	0.0734779	0.0000002	-0.2122497
11	0.3166380	1.3194400	0.0352671	0.8483738	0.31286	0.94980	0.0715738	0.0000003	-0.2746496
12	0.3999435	1.3917725	-0.0376076	0.8175012	0.25450	0.96707	0.0689167	0.0000002	-0.3427331
13	0.4832490	1.4641050	-0.0926393	0.7855970	0.20766	0.97833	0.0659617	0.0000002	-0.414301
14	0.5738500	1.5240450	-0.1314020	0.7531158	0.17367	0.98480	0.0631034	0.0000001	-0.4885556
15	0.6644510	1.5835850	-0.1541155	0.7194394	0.16440	0.98639	0.0604147	0.0000002	-0.5669662
16	0.7638835	1.6356550	-0.1697662	0.6844537	0.16440	0.98639	0.0574256	0.0000001	-0.6508143
17	0.8633160	1.6872250	-0.1812836	0.6491799	0.16440	0.98639	0.0542236	0.0000001	-0.7381838
18	0.963165	1.7310855	-0.1890568	0.6141450	0.16440	0.98639	0.0510144	0.0000001	-0.8279805
19	1.0753170	1.7748460	-0.1933094	0.5797300	0.16440	0.98639	0.0478577	0.0000001	-0.9193407
20	1.1861715	1.8113605	-0.1964849	0.5461897	0.16440	0.98639	0.0447342	0.0000001	-1.0116186
21	1.2970260	1.8478750	-0.1984572	0.5138301	0.15735	0.98754	0.0415148	0.0000001	-1.1035583
22	1.4115020	1.878015	-0.1987656	0.4831613	0.14405	0.98957	0.0384110	0.0000001	-1.1928155

3-BODY CASE NO. TEST

TEST CASE

GN-BGCY UNIFORM CROSS FLOW  
TRANSFORMED COORDINATES

	X	Y	T2	T3	SIN A	COS A	SIGMA	N	PHI
23	3.9986330	2.3260240	-0.1959838	0.4543702	0.13218	0.99123	0.0356482	0.0000001	-1.2782260
24	4.1234019	2.3426615	-0.1913419	0.4273429	0.12106	0.99265	0.0331015	0.0000001	-1.3598012
25	4.3732024	2.3745470	-0.1852776	0.4020731	0.11009	0.99392	0.0307326	0.0000001	-1.4372156
26	4.4982340	2.3897950	-0.1780925	0.3785578	0.09867	0.99512	0.0285211	0.0000002	-1.5100809
27	4.6234515	2.4036645	-0.1700288	0.3567997	0.08605	0.99629	0.0264508	0.0000001	-1.5779116
28	4.7486690	2.4175340	-0.1612794	0.3368188	0.07103	0.99747	0.0245040	0.0000001	-1.6400296
29	4.8740650	2.4295620	-0.1519486	0.3186784	0.05127	0.99868	0.0226608	0.0000001	-1.6953466
30	4.9993410	2.4423500	-0.1421024	0.3025579	0.02111	0.99978	0.0209543	0.0000001	-1.7417720
31	5.1247255	2.4532195	-0.1298604	0.2884135	0.	1.00000	0.0198461	0.0000001	-1.7789663
32	5.2501100	2.4640490	-0.1141936	0.2747074	0.	1.00000	0.0191568	0.0000001	-1.8132315
33	5.3754430	2.4729735	-0.0979210	0.2603280	0.	1.00000	0.0182641	0.0000001	-1.8491759
34	5.5007760	2.4818980	-0.0797128	0.2458317	0.	1.00000	0.0173047	0.0000001	-1.8854207
35	5.6258765	2.4883205	-0.0592687	0.2321834	0.	1.00000	0.0163875	0.0000001	-1.9195414
36	5.7509770	2.4947430	-0.0365228	0.2208774	0.	1.00000	0.0156552	0.0000000	-1.9478064
37	5.8754885	2.5000000	-0.0119181	0.2140739	0.	1.00000	0.0153181	0.0000000	-1.9648152
38	6.0000000	2.5000000	0.0119846	0.2144477	0.	1.00000	0.0156503	0.0000001	-1.9638808
39	6.1270445	2.5000000	0.0265113	0.2223098	0.	1.00000	0.0162867	0.0000000	-1.9442255
40	6.2540890	2.5000000	0.0450105	0.2322860	0.	1.00000	0.0119990	0.0000001	-1.9192849
41	6.4065425	2.5000000	-0.5060347	0.1665020	0.	-1.00000	-0.2326855	-0.0000005	-4.1674898
42	6.5589960	2.5000000	-0.1278910	0.1287015	0.	-1.00000	-0.1958089	-0.0000005	-4.3564924
43	6.7149400	2.5000000	-0.0457658	0.1163904	0.	-1.00000	-0.1852531	-0.0000005	-4.4180477
44	6.8924370	2.5000000							
45	7.0817900	2.5000000							
46	7.2817900	2.5000000							
47	7.49370135	2.5000000							
48	7.7172370	2.5000000							
49	7.9541774	2.5000000							
50	8.2069565	2.5000000							
51	8.4730840	2.5000000							
52	8.7484840	2.5000000							
53	9.024370	2.5000000							
54	9.3017900	2.5000000							
55	9.580290	2.5000000							
56	9.859565	2.5000000							
57	10.139895	2.5000000							
58	10.421180	2.5000000							
59	10.703590	2.5000000							
60	10.986180	2.5000000							
61	11.268870	2.5000000							
62	11.551660	2.5000000							
63	11.834450	2.5000000							
64	12.117240	2.5000000							
65	12.400030	2.5000000							
66	12.682820	2.5000000							
67	12.965610	2.5000000							
68	13.248400	2.5000000							
69	13.531190	2.5000000							
70	13.813980	2.5000000							
71	14.096770	2.5000000							
72	14.379560	2.5000000							
73	14.662350	2.5000000							
74	14.945140	2.5000000							
75	15.227930	2.5000000							
76	15.510720	2.5000000							
77	15.793510	2.5000000							
78	16.076300	2.5000000							
79	16.359090	2.5000000							
80	16.641880	2.5000000							
81	16.924670	2.5000000							
82	17.207460	2.5000000							
83	17.490250	2.5000000							
84	17.773040	2.5000000							
85	18.055830	2.5000000							
86	18.338620	2.5000000							
87	18.621410	2.5000000							
88	18.904200	2.5000000							
89	19.186990	2.5000000							
90	19.469780	2.5000000							
91	19.752570	2.5000000							
92	20.035360	2.5000000							
93	20.318150	2.5000000							
94	20.600940	2.5000000							
95	20.883730	2.5000000							
96	21.166520	2.5000000							
97	21.449310	2.5000000							
98	21.732100	2.5000000							
99	22.014890	2.5000000							
100	22.297680	2.5000000							



DOUGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

3-BODY CASE NO. TEST

TEST CASE

CN-BODY UNIFORM CROSS FLOW  
TRANSFORMED COORDINATES

	X	Y	T2	T3	SIN A	COS A	SIGMA	N	PHI
45	9.281790	5.000000	0.0016361	0.1138977	0.	-1.00000	-0.1806564	-0.0000004	-4.4305115
46	8.9024370	5.000000	0.0346369	0.1169007	0.	-1.00000	-0.1781795	-0.0000003	-4.4154966
47	8.2069565	5.000000	0.0615492	0.1227353	0.	-1.00000	-0.1764823	-0.0000003	-4.3863234
48	7.8908290	5.000000	0.0847648	0.1299740	0.	-1.00000	-0.1750985	-0.0000003	-4.3501258
49	7.6273895	5.000000	0.1052461	0.1377517	0.	-1.00000	-0.1738356	-0.0000003	-4.3112414
50	7.3639500	5.000000	0.1234927	0.1455297	0.	-1.00000	-0.1726019	-0.0000003	-4.2723515
51	7.1444170	5.000000	0.1398704	0.1529802	0.	-1.00000	-0.1713523	-0.0000003	-4.2350988
52	6.9248840	5.000000	0.1551398	0.1605088	0.	-1.00000	-0.1699436	-0.0000002	-4.1974560
53	6.7419400	5.000000	0.1713149	0.1687915	0.	-1.00000	-0.1681101	-0.0000002	-4.1560426
54	6.5589960	5.000000	0.1884145	0.1779608	0.	-1.00000	-0.1654807	-0.0000002	-4.1101958
55	6.4065425	5.000000	0.2017302	0.1880715	0.	-1.00000	-0.1608369	-0.0000002	-4.0596423
56	6.2540890	5.000000	0.2373048	0.1992169	0.03803	-0.99928	-0.1543143	-0.0000002	-4.0075912
57	6.1270445	5.000000	0.2817428	0.2116849	0.10637	-0.99433	-0.1502851	-0.0000002	-3.9594849
58	6.0000000	5.000000	0.3107114	0.2255229	0.16247	-0.98671	-0.1503696	-0.0000003	-3.9173708
59	5.8750000	5.000000	0.3345502	0.2404658	0.20457	-0.97885	-0.1530061	-0.0000003	-3.8803173
60	5.7500000	5.000000	0.3556180	0.2563748	0.23136	-0.97287	-0.1576521	-0.0000003	-3.8458544
61	5.6250000	5.000000	0.3752538	0.2731549	0.24171	-0.97035	-0.1639631	-0.0000003	-3.8104078
62	5.5000000	5.000000	0.3942142	0.2906831	0.23473	-0.97206	-0.1715592	-0.0000003	-3.7697085
63	5.3750000	5.000000	0.4133580	0.3087802	0.21022	-0.97766	-0.1798953	-0.0000003	-3.7195339
64	5.2500000	5.000000	0.4347328	0.3274676	0.16880	-0.98565	-0.1881493	-0.0000003	-3.6558178
65	5.1250000	5.000000	0.4611279	0.3470860	0.11167	-0.99375	-0.1951165	-0.0000002	-3.5745018
66	5.0000000	5.000000	0.4925189	0.3683239	0.04028	-0.99919	-0.1980338	-0.0000002	-3.4709530

3-BODY CASE NO. TEST

TEST CASE

CN-BODY UNIFORM CRSS FLOW  
TRANSFORMED COORDINATES

	X	Y	T2	T3	SIN A	COS A	SIGMA	N	PHI
67	2.0000000	5.5000000							
	1.8869355	5.5004695	0.5696822	0.3916020	0.00415	-0.99999	-0.1934799	-0.0000001	-3.3464746
68	1.7738710	5.5005390							
	1.6733840	5.5036335	0.6922586	0.4164471	0.02680	-0.99964	-0.1837712	-0.0000002	-3.2116611
69	1.5728970	5.5063280							
	1.4761160	5.5128890	0.8114604	0.4431232	0.06764	-0.99771	-0.1749310	-0.0000002	-3.0699999
70	1.3793350	5.5194500							
	1.2870955	5.5310315	0.9414069	0.4721985	0.12458	-0.99221	-0.1655381	-0.0000002	-2.9192867
71	1.1948560	5.5426130							
	1.1069210	5.5601135	1.0799738	0.5033654	0.19519	-0.98077	-0.1552723	-0.0000002	-2.7613446
72	1.0189860	5.5776140							
	0.9352410	5.6017940	1.2251820	0.5364781	0.27740	-0.96075	-0.1437517	-0.0000002	-2.5965540
73	0.8514960	5.6259740							
	0.7730140	5.6570970	1.3734992	0.5711673	0.36863	-0.92957	-0.1305619	-0.0000001	-2.4259481
74	0.6945220	5.6882200							
	0.6209400	5.7270205	1.5198023	0.6071239	0.46638	-0.88458	-0.1154487	-0.0000001	-2.2500096
75	0.5473480	5.7658210							
	0.4810835	5.8114300	1.6589674	0.6437109	0.56697	-0.82374	-0.0979654	-0.0000001	-2.0705491
76	0.4148190	5.8570390							
	0.3556720	5.9098540	1.7813848	0.6802114	0.66633	-0.74565	-0.0781858	-0.0000002	-1.8899169
77	0.2965250	5.9627490							
	0.2457330	6.0223250	1.8807712	0.7162368	0.76098	-0.64878	-0.0557357	-0.0000002	-1.7089142
78	0.1949410	6.0815010							
	0.1537080	6.1473550	1.9467971	0.7510047	0.84611	-0.53301	-0.0306205	-0.0000002	-1.5306624
79	0.1124750	6.2128090							
	0.0819055	6.2829825	1.9674952	0.7836877	0.91679	-0.39938	-0.0029158	-0.0000001	-1.3590862
80	0.0513360	6.3531560							
	0.0323615	6.4265920	1.9264472	0.8133826	0.96820	-0.25017	0.0273381	-0.0000001	-1.1993136
81	0.0133870	6.5000280							
	0.0066935	6.5750140	1.7830468	0.8389030	0.99604	-0.08891	0.0607916	-0.0000000	-1.0592153
82	0.	6.6500000							
	0.	6.7412925	1.5729730	0.8601151	1.00000	0.	0.0751876	-0.0000000	-0.9430052
83	0.	6.8325850							
	0.	6.9421365	1.4282942	0.8780714	1.00000	0.	0.0674265	-0.0000000	-0.8464448
84	0.	7.0516880							
	0.	7.1831495	1.3348176	0.8944654	1.00000	0.	0.0595343	-0.0000000	-0.7580705
85	0.	7.3146110							
	0.	7.4723650	1.2649974	0.9096543	1.00000	0.	0.0519221	-0.0000000	-0.6750962
86	0.	7.6301190							
	0.	7.8194235	1.2098988	0.9236789	1.00000	0.	0.0446786	-0.0000000	-0.5967867
87	0.	8.0087280							
	0.	8.2358935	1.1653509	0.9364801	1.00000	0.	0.0378780	-0.0000000	-0.5231430
88	0.	8.4630585							
	0.	8.7356575	1.1290117	0.9479727	1.00000	0.	0.0315930	-0.0000000	-0.4544929

DOUGLAS AIRCRAFT COMPANY  
LCMC BEACH DIVISION

TEST CASE 3-BODY CASE NO. TEST

GN-BODY UNIFORM CROSS FLOW  
TRANSFORMED COORDINATES

	X	Y	T2	T3	SIN A	COS A	SIGMA	N	PHI
89	0.	9.0082560	1.0993863	0.9580846	1.00000	0.	0.0258844	-0.0000000	-0.3912956
90	0.	9.3353745	1.0754161	0.9667812	1.00000	0.	0.0207938	-0.0000000	-0.3340164
91	0.	10.0550350	1.0563795	0.9740811	1.00000	0.	0.0163409	-0.0000000	-0.2829989
92	0.	10.4475770	1.0409711	0.9796125	1.00000	0.	0.0127984	-0.0000000	-0.2419592
93	0.	11.8680295	1.0304283	0.9835025	1.00000	0.	0.0101733	-0.0000000	-0.2115760
94	0.	12.3463805	1.0229304	0.9862966	1.00000	0.	0.0081949	-0.0000000	-0.1888524
95	0.	12.8247315	1.0173456	0.9883488	1.00000	0.	0.0066744	-0.0000000	-0.1717163
96	0.	13.3030829	1.0129941	0.9898788	1.00000	0.	0.0054877	-0.0000000	-0.1588497
97	0.	14.2597851	1.0094112	0.9910268	1.00000	0.	0.0045497	-0.0000000	-0.1494180
98	0.	15.2164880	1.0062029	0.9918814	1.00000	0.	0.0038003	-0.0000000	-0.1429536
99	0.	16.6515410	1.0028322	0.9924921	1.00000	0.	0.0031960	-0.0000000	-0.1393844
100	0.	17.6082430	0.9973935	0.9928516	1.00000	0.	0.0027047	-0.0000000	-0.1395481
101	0.	18.0865941	0.0733774	0.2037793	1.00000	0.	-0.0505576	0.0000000	-2.3223103
102	12.0000000	2.5000000	0.1788418	0.1752846	1.00000	0.	-0.0861733	0.0000000	-3.0926827
103	12.0000000	2.9166665	0.6107001	0.1853266	1.00000	0.	-0.1601152	0.0000000	-3.7339197
104	12.0000000	3.3333330							
105	12.0000000	3.7500000							
106	12.0000000	4.1666670							
107	12.0000000	4.5833335							
108	12.0000000	5.0000000							

ADDED MASS = 622.7799301 VOLUME = -811.6679382

TEST CASE 3-BODY CASE NO. TEST

OFF-BODY UNIFORM CROSS FLEA  
TRANSFORMED COORDINATES

	X	Y	VX	VY	VZ	PHI
1	2.0000000	2.5000000	-0.1997469	0.1386537	0.6026236	-0.9934410
2	2.0000000	3.0000000	-0.2656179	0.2163255	0.5326011	-1.4021966
3	2.0000000	3.5000000	-0.3351830	0.2473314	0.4900668	-1.7847660
4	2.0000000	4.0000000	-0.4067216	0.2461933	0.4599611	-2.1601555
5	2.0000000	4.5000000	-0.4772017	0.2143952	0.4347488	-2.5436304
6	2.0000000	5.0000000	-0.5349454	0.1437170	0.4095616	-2.9521919
7	4.0000000	2.5000000	-0.2103406	0.0343569	0.3971312	-1.6578893
8	4.0000000	3.0000000	-0.2195174	0.0560405	0.3678649	-1.8964053
9	4.0000000	3.2500000	-0.2299844	0.0705222	0.3444597	-2.1305059
10	4.0000000	3.5000000	-0.2413607	0.0782452	0.3251820	-2.3618630
11	4.0000000	3.7500000	-0.2533831	0.0819387	0.3088646	-2.5917577
12	4.0000000	4.0000000	-0.2658909	0.0821508	0.2947040	-2.8211838
13	4.0000000	4.2500000	-0.2788359	0.0797659	0.2821414	-3.0508990
14	4.0000000	4.5000000	-0.2922953	0.0756843	0.2707905	-3.2814425
15	4.0000000	4.7500000	-0.3064387	0.0709865	0.2603980	-3.5131096
16	6.0000000	2.5000000	-0.1356797	0.0118466	0.2688950	-2.0105387
17	6.0000000	3.0000000	-0.1357801	0.0207792	0.2478768	-2.2563695
18	6.0000000	3.2500000	-0.1370509	0.0258182	0.2306238	-2.5004726
19	6.0000000	3.5000000	-0.1390031	0.0277524	0.2160805	-2.7437181
20	6.0000000	3.7500000	-0.1413020	0.0271705	0.2035185	-2.9868057
21	6.0000000	4.0000000	-0.1436737	0.0245176	0.1924236	-3.2303058
22	6.0000000	4.2500000	-0.1459733	0.0201519	0.1824260	-3.4746896
23	6.0000000	4.5000000	-0.1476750	0.0143963	0.1732566	-3.7203452
24	6.0000000	4.7500000	-0.1488967	0.0075804	0.1647201	-3.9675793

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DUCLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

PROGRAM EODA -- AXISYMMETRIC AND CROSSFLOW

\*\*\*\*\* CASE CONTROL DATA \*\*\*\*\*

TEST CASE 1-6-72                      2-BODY      CASE NO.      TEST

BCCIES = 2  
NNU = -0  
CHCRD = 1.0000000  
MACH NO. = -C.  
TCNST = -0.

SURFACE OF REVOLUTION  
OFF-BODY POINTS  
MATRIX SOLUTION BY TRIANGULARIZATION (SOLVIT)  
INPUT TAPE NO. FOR COORDINATES AND NON-UNIFORM FLOW ONLY = 5

2-80DY

TEST CASE 1-6-72

NN = 41  
THETA = -0.  
XE = -0.

MX = -0.  
ADCX = -0.  
YE = -0.

MY = -0.  
ADDY = -0.

CN-BODY COORDINATES (UNTRANSFORMED)

BODY NO. 1

	X	Y	DELTA S	SUMDS	D ALPHA
1	0.	0.	0.2500000	0.2500000	0.
2	0.	0.1250000	0.2500000	0.5000000	-3.8241162
3	-0.	0.2500000	0.2512674	0.7512674	-11.7650077
4	0.0083790	0.6253540	0.2186078	0.9698752	-12.6493235
5	0.0167580	0.7507080	0.2163621	1.1862373	-11.3918442
6	0.0461320	0.8555910	0.2175528	1.4037901	-9.4025823
7	0.0755060	0.9612740	0.2206517	1.6244419	-7.4792177
8	0.1266910	1.0565800	0.2172680	1.8417099	-6.0293090
9	0.1778760	1.1518860	0.2241126	2.0658224	-5.0261505
10	0.2472570	1.2356630	0.2293564	2.2951787	-4.2010204
11	0.3166380	1.3194400	0.2334269	2.5286056	-3.4872889
12	0.3999435	1.3917725	0.2367476	2.7653532	-2.7941246
13	0.4832490	1.4641050	0.2397538	3.0051070	-1.9488477
14	0.5738500	1.5240450	0.2431590	3.2482660	-0.5387681
15	0.6644510	1.5839850	0.2534485	3.5017145	-0.0002325
16	0.7638835	1.6356550	0.2534483	3.7551628	0.0002325
17	0.8633160	1.6873250	0.2534485	4.0086113	0.
18	0.9693165	1.7310855	0.2534485	4.2620597	-0.0002325
19	1.0753170	1.7748460	0.2534483	4.5155081	0.0002325
20	1.1861715	1.8113605	0.2529673	4.7689565	-0.4091516
21	1.2970260	1.8478750	0.2514393	5.0219238	-0.7711682
22	1.4115020	1.8780015		5.2733631	-0.6866971
23	1.5259780	1.9081280			
24	1.6432570	1.9329495			
25	1.7605360	1.9577710			
26	1.8802680	1.9788855			
27	2.0000000	2.0000000			
28	2.1250000	2.0208335			
29	2.2500000	2.0416670			
30	2.3750000	2.0625000			
31	2.5000000	2.0833330			
32	2.6250000	2.1041665			
33	2.7500000	2.1250000			
34	2.8750000	2.1458335			
35	3.0000000	2.1666670			
36	3.1250000	2.1875000			
37	3.2500000	2.2083330			
38	3.3750000	2.2291665			
39	3.5000000	2.2500000			
40	3.6249080	2.2695025			
41	3.7498160	2.2898050			
42	3.8742245	2.3079145			
43	3.9986330	2.3260240			

24	4.1234019	2.3426615	0.2517468	5.5251098	-0.6423096
	4.2481710	2.3592590			
	4.3732024	2.3745470	0.2519157	5.7770255	-0.6325730
25	4.4982340	2.3897950			
	4.6234515	2.4036645	0.2519666	6.0289921	-0.6577064
26	4.7486690	2.4175340			
	4.8740050	2.4295620	0.2519013	6.2808933	-0.7263850
27	4.9993410	2.4423900			
	5.1247255	2.4532195	0.2517026	6.5325959	-0.8634634
28	5.2501100	2.4640490			
	5.3754430	2.4725735	0.2513007	6.7838966	-1.1340301
29	5.5007760	2.4818980			
	5.6258765	2.4883205	0.2505305	7.0344270	-1.7295423
30	5.7509770	2.4947430			
	5.8754885	2.4973715	0.2490785	7.2835055	-1.2093652
31	6.0000000	2.5000000			
	6.1270445	2.5000000	0.2540890	7.5375945	0.
32	6.2540890	2.5000000			
	6.4065425	2.5000000	0.3049070	7.8425015	0.
33	6.5589960	2.5000000			
	6.7419400	2.5000000	0.3658880	8.2083895	0.
34	6.9248840	2.5000000			
	7.1444170	2.5000000	0.4390660	8.6474555	0.
35	7.3639500	2.5000000			
	7.6273895	2.5000000	0.5268790	9.1743344	0.
36	7.8908290	2.5000000			
	8.2069565	2.5000000	0.6322550	9.8065894	0.
37	8.5230840	2.5000000			
	8.9024370	2.5000000	0.7587060	10.5652952	0.
38	9.2817900	2.5000000			
	9.7370135	2.5000000	0.9104470	11.4757422	0.
39	10.1922370	2.5000000			
	10.6441774	2.5000000	0.9038810	12.3796232	0.
40	11.0961180	2.5000000			
	11.5480590	2.5000000	0.9038820	13.2835052	
41	12.0000000	2.5000000			

2-BODY

TEST CASE 1-6-72

NN = 60  
THETA = -0.  
XE = -0.

MX = -0.  
ACEX = -0.  
YE = -0.

MY = -0.  
ADDY = -0.

CA-BODY COORDINATES (UNTRANSFORMED)

BODY NO. 2

	X	Y	DELTA S	SUMDS	D ALPHA
1	12.000000	5.000000	0.9038820	0.9038820	0.
2	11.5480590	5.000000	0.9038810	1.8077630	0.
3	10.6441774	5.000000	0.9104470	2.7182100	0.
4	9.7370135	5.000000	0.7587060	3.4769159	0.
5	8.9024370	5.000000	0.6322550	4.1091709	0.
6	8.2069565	5.000000	0.5268790	4.6360499	0.
7	7.6273895	5.000000	0.4390660	5.0751159	0.
8	7.1444170	5.000000	0.3658880	5.4410039	0.
9	6.7419400	5.000000	0.3049070	5.7459109	0.
10	6.4065425	5.000000	0.2540890	5.9999999	0.
11	6.1270445	5.000000	0.2500000	6.2499999	0.
12	5.8750000	5.000000	0.2500000	6.4999999	0.
13	5.7500000	5.000000	0.2500000	6.7499999	0.
14	5.6250000	5.000000	0.2500000	6.9999999	-2.1792316
15	5.5000000	5.000000	0.2414166	7.2414165	-3.9268209
16	4.8793790	5.0045900	0.2545572	7.4959737	-3.2439557
17	4.7587580	5.0091800	0.2687100	7.7646837	-2.4545241
18	4.6322015	5.0227185	0.2825291	8.0472127	-1.5724325
19	4.5056450	5.0362570	0.2943809	8.3415935	-0.6106070
20	4.3730749	5.0580850	0.3026377	8.6442312	0.4115753
21	4.2405050	5.0799130	0.3032613	8.9474925	1.4410384
22	4.1022280	5.1088120	0.2945650	9.2420574	2.4166217
23	3.9639510	5.1377110			
24	3.8207540	5.1717645			
25	3.6775570	5.2058180			
26	3.5307250	5.2423935			
27	3.3838930	5.2785690			
28	3.2364990	5.3145620			
29	3.0891050	5.3501550			
30	2.9451135	5.3811160			
31	2.8011220	5.4120770			



24	2.6620285	5.4358585	0.2822372	9.5242946	3.3069454
	2.5229350	5.4597200			
25	2.3897135	5.4746900	0.2681199	9.7924144	4.1028724
	2.2564920	5.4896600			
26	2.1282460	5.4948300	0.2567003	10.0491147	2.0705958
	2.0000000	5.5000000			
27	1.8869335	5.5004695	0.2261309	10.2752455	-1.2980553
	1.7738710	5.5093390			
28	1.6733840	5.5036335	0.2010462	10.4762918	-2.3423041
	1.5728570	5.5063280			
29	1.4761160	5.5128890	0.1940063	10.6702980	-3.2782757
	1.3793350	5.5194500			
30	1.2870955	5.5310315	0.1859275	10.8562254	-4.0991654
	1.1948560	5.5426130			
31	1.1069210	5.5601135	0.1793191	11.0355444	-4.8494838
	1.0189860	5.5776140			
32	0.9352410	5.6017940	0.1743318	11.2098762	-5.5262105
	0.8514960	5.6259740			
33	0.7730140	5.6570970	0.1688557	11.3787318	-6.1684719
	0.6945320	5.6882200			
34	0.6209400	5.7270205	0.1663882	11.5451200	-6.7392436
	0.5473480	5.7658210			
35	0.4810835	5.8114300	0.1608871	11.7060070	-7.2455193
	0.4148190	5.8570390			
36	0.3556720	5.9098940	0.1586445	11.8646514	-7.7658312
	0.2965250	5.9627490			
37	0.2457330	6.0222250	0.1565775	12.0212289	-8.2404850
	0.1949410	6.0815010			
38	0.1537080	6.1473550	0.1547176	12.1759465	-8.6697624
	0.1124750	6.2128090			
39	0.0819055	6.2829825	0.1530857	12.3290322	-9.0519558
	0.0513360	6.3531560			
40	0.0323615	6.4265920	0.1516955	12.4807277	-9.3864200
	0.0133870	6.5000280			
41	0.0066935	6.5750140	0.1505683	12.6312959	-5.1008937
	0.0000000	6.6500000			
42	0.0000000	6.7412925	0.1825850	12.8138809	0.0000000
	0.0000000	6.8325850			
43	0.0000000	6.9421365	0.2191030	13.0329839	0.0000000
	0.0000000	7.0516880			
44	0.0000000	7.1831495	0.2629230	13.2959069	0.0000000
	0.0000000	7.3146110			
45	0.0000000	7.4723650	0.3155080	13.6114149	0.0000000
	0.0000000	7.6301190			
46	0.0000000	7.8194235	0.3786090	13.9900239	0.0000000
	0.0000000	8.0087280			
47	0.0000000	8.2358935	0.4543309	14.4443548	0.0000000
	0.0000000	8.4630585			
48	0.0000000	8.7365575	0.5451970	14.9895518	0.0000000
	0.0000000	9.0082560			
49	0.0000000	9.3353745	0.6542370	15.6437888	0.0000000
	0.0000000	9.6624930			
50	0.0000000	10.0500350	0.7850840	16.4288726	0.0000000
	0.0000000	10.4475770			
51	0.0000000	10.9186275	0.9421010	17.3709736	0.0000000
	0.0000000	11.3896780			
52	0.0000000	11.8680295	0.9567029	18.3276765	0.0000000
	0.0000000	12.3463809			
53	0.0000000	12.8247315	0.9567020	19.2843785	0.0000000
	0.0000000	13.3030829			

54	0.	13.7814339	0.9567021	20.2410805	0.
	0.	14.2597851			
	0.	14.7381365	0.9567029	21.1977835	0.
55	0.	15.2164880			
	0.	15.6948390	0.9567021	22.1544855	0.
56	0.	16.1731901			
	0.	16.6515410	0.9567020	23.1111875	0.
57	0.	17.1298921			
	0.	17.6082430	0.9567020	24.0678895	0.
58	0.	18.0865941			
	0.	18.5645455	0.9567029	25.0245924	0.
59	0.	19.0432971			
	0.	19.5216484	0.9567029	25.9812953	0.
60	0.	20.0000000			

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

TEST CASE 1-6-72 2-BODY

NN = 24      MX = -0.      MY = -0.  
 THETA = -0.      ACIX = -0.      ADDY = -0.  
 XE = -0.      YE = -0.

GFF-BCDY COORDINATES (UNTRANSFORMED)

	X-OFF	Y-OFF
1	2.000000	2.500000
2	2.000000	3.000000
3	2.000000	3.500000
4	2.000000	4.000000
5	2.000000	4.500000
6	2.000000	5.000000
7	4.000000	2.750000
8	4.000000	3.000000
9	4.000000	3.250000
10	4.000000	3.500000
11	4.000000	3.750000
12	4.000000	4.000000
13	4.000000	4.250000
14	4.000000	4.500000
15	4.000000	4.750000
16	6.000000	2.750000
17	6.000000	3.000000
18	6.000000	3.250000
19	6.000000	3.500000
20	6.000000	3.750000
21	6.000000	4.000000
22	6.000000	4.250000
23	6.000000	4.500000
24	6.000000	4.750000

THE 55 X 99 MATRIX WITH 1 RIGHT SIDES WAS SOLVED DIRECTLY IN 0.005 MINUTES.

TEST CASE 1-6-72

2-BODY CASE NO. TEST

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	T1	CP	SIN A	COS A	SIGMA	N	PHI
1	0.	0.	0.0368556	0.9986417	1.00000	0.	-0.1115199	-0.0000002	-16.2307770
2	0.	0.1250000	0.1107042	0.9877446	1.00000	-0.	-0.1084210	-0.0000002	-16.2114217
3	-0.	0.2500000	0.2311244	0.9465815	0.99777	0.06669	-0.1010254	-0.0000002	-16.1744015
4	0.	0.5000000	0.4241823	0.8200694	0.96321	0.26874	-0.0881396	-0.0000002	-16.1315036
5	0.0083790	0.6253540	0.5894228	0.6525808	0.88099	0.47314	-0.0764615	-0.0000002	-16.0984416
6	0.0167580	0.7507080	0.7220999	0.4785718	0.77018	0.63783	-0.0655820	-0.0000003	-16.0735321
7	0.0461320	0.8559910	0.8223597	0.3237245	0.65563	0.75509	-0.0562167	-0.0000003	-16.0542350
8	0.0755060	0.9612740	0.8983284	0.1930060	0.55176	0.83400	-0.0483404	-0.0000003	-16.0374880
9	0.1266910	1.0565800	0.9570601	0.0840360	0.46111	0.88734	-0.0417518	-0.0000003	-16.0207942
10	0.1778760	1.1518860	1.0054000	-0.0108292	0.38159	0.92433	-0.0358470	-0.0000001	-16.0018842
11	0.2472570	1.2356630	1.0443714	-0.0307116	0.31286	0.94980	-0.0305269	-0.0000001	-15.9798419
12	0.3166380	1.3194400	1.0741802	-0.1538631	0.25450	0.96707	-0.0258086	-0.0000001	-15.9545302
13	0.3999435	1.3917725	1.0944336	-0.1977849	0.20706	0.97833	-0.0219283	-0.0000001	-15.9265398
14	0.4832490	1.4641050	1.1053718	-0.2218468	0.17367	0.98480	-0.0196115	-0.0000001	-15.8970640
15	0.5738500	1.5240450	1.1155474	-0.2444461	0.16440	0.98639	-0.0207712	-0.0000001	-15.8667105
16	0.6644510	1.5839850	1.1350309	-0.26882950	0.16440	0.98639	-0.0229412	-0.0000001	-15.8325100
17	0.7638835	1.6356550	1.1620884	-0.3504495	0.16440	0.98639	-0.0247087	-0.0000001	-15.7921322
18	0.8633160	1.6873250	1.1933895	-0.4241786	0.16440	0.98639	-0.0262469	-0.0000001	-15.7442549
19	0.9693165	1.7310855	1.2284557	-0.5091033	0.16440	0.98639	-0.0276340	-0.0000001	-15.6879194
20	1.0753170	1.7748460	1.2687418	-0.6097057	0.16440	0.98639	-0.0288922	-0.0000001	-15.6220624
21	1.1861715	1.8113605	1.3134119	-0.7250508	0.15735	0.98754	-0.0286244	-0.0000001	-15.5449587
22	1.4115020	1.878015	1.3555952	-0.8376385	0.14405	0.98957	-0.0269675	-0.0000001	-15.4569756

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

2-BODY CASE NO. TEST

TEST CASE 1-6-72

CN-BECY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	TL	CP	SIN A	COS A	SIGMA	N	PHI
23	3.9986330	2.3260240	1.3928830	-0.9401229	0.13218	0.99123	-0.0254793	-0.0000001	-15.3598396
24	4.1234019	2.3426615	1.4280763	-1.0394019	0.12106	0.99265	-0.0239671	-0.0000001	-15.2538805
25	4.3732024	2.3745470	1.4616471	-1.1364123	0.11009	0.99392	-0.0223051	-0.0000001	-15.1395010
26	4.4982340	2.3897950	1.4936022	-1.2308476	0.09867	0.99512	-0.0203810	-0.0000001	-15.0170884
27	4.6234515	2.4175340	1.5237888	-1.3219323	0.08605	0.99629	-0.0180527	-0.0000001	-14.8870699
28	4.7486690	2.4295620	1.5517787	-1.4080172	0.07103	0.99747	-0.0150735	-0.0000001	-14.7499491
29	4.8740050	2.4432195	1.5757380	-1.4829502	0.05127	0.99868	-0.0109081	-0.0000001	-14.6064662
30	5.007760	2.4640490	1.5841553	-1.5095479	0.02111	0.99978	-0.0041475	-0.0000000	-14.4584720
31	5.1247255	2.4725735	1.5707382	-1.4672185	0.	1.00000	0.0005090	-0.0000000	-14.3111918
32	5.2501100	2.4818980	1.55559135	-1.4208667	0.	1.00000	0.0002075	-0.0000000	-14.1542984
33	5.3754430	2.4947430	1.5500170	-1.4025528	0.	1.00000	0.0000781	-0.0000000	-13.9690569
34	5.507760	2.5000000	1.5472057	-1.3938453	0.	1.00000	0.0000446	-0.0000000	-13.7483451
35	5.6258765	2.5000000	1.5457722	-1.3894116	0.	1.00000	0.0000719	-0.0000000	-13.4844381
36	5.7488840	2.5000000	1.5448672	-1.3866147	0.	1.00000	0.0001496	-0.0000000	-13.1683471
37	5.8702430	2.5000000	1.5438080	-1.3833432	0.	1.00000	0.0003045	-0.0000000	-12.7896081
38	5.9933410	2.5000000	1.5412707	-1.3755152	0.	1.00000	0.0006430	-0.0000000	-12.3362961
39	6.1192230	2.5000000	1.5345076	-1.3547136	0.	1.00000	0.0013419	-0.0000000	-11.8469679
40	6.2441774	2.5000000	1.5157102	-1.2973773	0.	1.00000	0.0025366	0.0000000	-11.3693341
41	6.3695000	2.5000000							
42	6.4905000	2.5000000	-1.5710313	-1.4681394	0.	-1.00000	-0.0207993	-0.0000000	-11.3278660
43	6.6118000	2.5000000	-1.5492320	-1.4001197	0.	-1.00000	-0.0230825	-0.0000000	-11.8341868
44	6.730135	2.5000000	-1.5446047	-1.3858038	0.	-1.00000	-0.0248907	-0.0000000	-12.3321306

TEST CASE 1-6-72

2-BODY CASE NO. TEST

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	Z	TI	CP	SIN A	COS A	SIGMA	N	PHI
45	9.281790C	5.000000C		-1.5442578	-1.3847322	0.	-1.00000	-0.0261733	-0.0000000	-12.7878705
46	8.902437C	5.000000C		-1.5444015	-1.3851761	0.	-1.00000	-0.0269431	-0.0000000	-13.1671507
47	8.523084C	5.000000C		-1.5445436	-1.3856151	0.	-1.00000	-0.0273490	-0.0000000	-13.4830229
48	7.890829C	5.000000C		-1.5446845	-1.3860503	0.	-1.00000	-0.0274908	-0.0000000	-13.7461405
49	7.6273895	5.000000C		-1.5450199	-1.3870863	0.	-1.00000	-0.0274330	-0.0000000	-13.9653823
50	7.363950C	5.000000C		-1.5458399	-1.3896211	0.	-1.00000	-0.0272197	-0.0000000	-14.1481954
51	6.924884C	5.000000C		-1.5474401	-1.3945710	0.	-1.00000	-0.0268846	-0.0000000	-14.3008221
52	6.751940C	5.000000C		-1.5506541	-1.4045280	0.	-1.00000	-0.026414C	-0.0000000	-14.4389983
53	6.558996C	5.000000C		-1.5569644	-1.4241381	0.	-1.00000	-0.0257242	-0.0000000	-14.5771244
54	6.4065425	5.000000C		-1.5699865	-1.4648576	0.	-1.00000	-0.0246909	0.0000000	-14.7174332
55	6.1270445	5.000000C		-1.6036117	-1.5715704	0.	-1.00000	-0.0229665	0.0000000	-14.8627499
56	5.875000C	5.000000C		-1.6394832	-1.6879051	0.03803	-0.99928	-0.0304354	-0.0000000	-15.0184156
57	4.879379C	5.004590C		-1.6250398	-1.6407544	0.10637	-0.99433	-0.0461289	-0.0000000	-15.1826950
58	4.758758C	5.009180C		-1.5630248	-1.4430465	0.16247	-0.98671	-0.0588651	-0.0000000	-15.3458402
59	4.5056450	5.036257C		-1.4771779	-1.1820547	0.20457	-0.97885	-0.0678013	-0.0000001	-15.4976983
60	4.3730749	5.079513C		-1.3817395	-0.9092039	0.23136	-0.97287	-0.072458C	-0.0000001	-15.6305587
61	4.2405050	5.106812C		-1.2874888	-0.6576273	0.24171	-0.97035	-0.0725212	-0.0000001	-15.7389437
62	3.820754C	5.1717645		-1.2029944	-0.4471955	0.23473	-0.97206	-0.0678099	-0.0000001	-15.8198332
63	3.677557C	5.205818C		-1.1346654	-0.2874656	0.21022	-0.97766	-0.0584032	-0.0000000	-15.8736186
64	3.530725C	5.2423935		-1.0874014	-0.1824419	0.16880	-0.98565	-0.0445982	-0.0000000	-15.9049556
65	3.383893C	5.314562C		-1.0660751	-0.1365161	0.11167	-0.99375	-0.0268290	0.0000000	-15.9214442
66	3.236499C	5.350155C		-1.0850452	-0.1773231	0.04028	-0.99919	-0.0056734	0.0000001	-15.9331512

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

2-BODY CASE NO. TEST

TEST CASE 1-6-72

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	T1	CP	SIN A	CCS A	SIGMA	N	PHI
67	2.0000000	5.5000000	-1.1398952	-0.2993612	0.00415	-0.99999	0.0089669	0.0000001	-15.9546909
68	1.8869355	5.5004695	-1.2070558	-0.4569836	0.02680	-0.99964	0.0116082	0.0000001	-15.9912541
69	1.7738710	5.5005390	-1.2618782	-0.5923366	0.06764	-0.99771	0.0101827	0.0000001	-16.0383403
70	1.5728970	5.5063280	-1.3059200	-0.7054269	0.12458	-0.99221	0.0056303	0.0000001	-16.0945370
71	1.4761160	5.5128890	-1.3361031	-0.7851714	0.19519	-0.98077	-0.0014069	0.0000000	-16.1575143
72	1.3793350	5.5194500	-1.3495324	-0.8212376	0.27740	-0.96075	-0.0103935	0.0000000	-16.2256000
73	1.2870955	5.5310315	-1.3441836	-0.8068296	0.36863	-0.92957	-0.0207996	0.0000000	-16.2970641
74	1.1948560	5.5426130	-1.3176214	-0.7361262	0.46638	-0.88458	-0.0322180	-0.0000001	-16.3708076
75	1.1069210	5.5601135	-1.2705157	-0.6142102	0.56697	-0.82374	-0.0441028	-0.0000001	-16.4454610
76	1.0189860	5.5776140	-1.2022244	-0.4453436	0.66633	-0.74565	-0.0561202	-0.0000001	-16.5202377
77	0.9352410	5.6017440	-1.1140614	-0.2411328	0.76098	-0.64878	-0.0680253	-0.0000001	-16.5953908
78	0.8514960	5.6259740	-1.0080538	-0.0161724	0.84611	-0.53301	-0.0796486	-0.0000001	-16.6709387
79	0.7730140	5.6570970	-0.8865950	0.2139493	0.91679	-0.39938	-0.0910778	-0.0000001	-16.7472491
80	0.6945320	5.6882200	-0.7506861	0.4364704	0.96820	-0.25017	-0.1029392	-0.0000000	-16.8248591
81	0.6209400	5.7270205	-0.5858928	0.6567297	0.99604	-0.08891	-0.1177322	-0.0000000	-16.9036355
82	0.5473480	5.7658210	-0.4328423	0.8126475	1.00000	0.	-0.1303247	0.0000000	-16.9843843
83	0.4810835	5.8114300	-0.3431347	0.8822586	1.00000	0.	-0.1359790	0.0000000	-17.0633900
84	0.4148190	5.8570390	-0.2640104	0.9302985	1.00000	0.	-0.1391819	0.0000000	-17.1371088
85	0.3556720	5.9098940	-0.1931200	0.9627047	1.00000	0.	-0.1416185	0.	-17.2037122
86	0.2965250	5.9627490	-0.1275582	0.9837289	1.00000	0.	-0.1437301	0.0000000	-17.2599022
87	0.2457330	6.0223250	-0.0655747	0.9956999	1.00000	0.	-0.1456896	0.0000000	-17.3007567
88	0.1949410	6.0815010	-0.0058820	0.9999654	1.00000	0.	-0.1475605	0.0000000	-17.3193846

DOUGLAS AIRCRAFT COMPANY  
LONG BEACH DIVISION

TEST CASE 1-6-72 2-BODY CASE NO. TEST

CN-BODY UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	TI	CP	SIN A	COS A	SIGMA	N	PHI
89	0.	9.0082560	0.0527286	0.9972197	1.00000	0.	-0.1493496	0.0000000	-17.3062739
90	0.	9.3353745	0.1116719	0.9875294	1.00000	0.	-0.1510347	0.0000000	-17.2482390
91	0.	10.0550350	0.1729392	0.9700920	1.00000	0.	-0.1525834	0.0000000	-17.1266842
92	0.	10.4475770	0.2334948	0.9454802	1.00000	0.	-0.1538652	0.0000001	-16.9351134
93	0.	10.9186275	0.2922462	0.9145922	1.00000	0.	-0.1548430	0.0000000	-16.6848519
94	0.	11.3896780	0.3518597	0.8761947	1.00000	0.	-0.1555961	0.0000000	-16.3779094
95	0.	12.8247315	0.4153347	0.8274971	1.00000	0.	-0.1561854	0.0000001	-16.0121262
96	0.	13.3030829	0.4863692	0.7634450	1.00000	0.	-0.1566530	0.0000000	-15.5821936
97	0.	14.2597851	0.5706610	0.6743460	1.00000	0.	-0.1570286	0.0000003	-15.0784303
98	0.	15.2164880	0.6791185	0.5387981	1.00000	0.	-0.1573336	0.0000001	-14.4836129
99	0.	16.6515410	0.8394643	0.2952997	1.00000	0.	-0.1575836	0.0000000	-13.7637696
100	0.	17.1298921	1.1804616	-0.3934896	1.00000	0.	-0.1577905	0.0000001	-12.8270314
101	0.	18.0865941							
	0.	18.5645455							
	0.	19.0432971							
	0.	19.5216484							
	0.	20.0000000							

ADDED MASS = 8747.2006836 VOLUME = -811.6679382 SUM (T)(DELTA S) = 3.9540037



DOUGLAS AIRCRAFT COMPANY  
LCNG BEACH DIVISION

TEST CASE 1-6-72

2-BODY CASE NO. TEST

CFF-BCOV UNIFORM AXISYMMETRIC FLOW  
TRANSFORMED COORDINATES

	X	Y	VX	VY	VT	THETA	PHI
1	2.000000	2.500000	1.0874072	0.1080623	1.0927635	5.6752004	-15.8084060
2	2.000000	3.000000	1.0907982	0.0328161	1.0912917	1.7231947	-15.7736236
3	2.000000	3.500000	1.0976801	-0.0306208	1.0981071	-1.5979064	-15.7736020
4	2.000000	4.000000	1.1057853	-0.0802595	1.1086941	-4.1513335	-15.8019654
5	2.000000	4.500000	1.1135746	-0.1104439	1.1190381	-5.6640478	-15.8506728
6	2.000000	5.000000	1.1165079	-0.1049762	1.1214321	-5.3712682	-15.9065968
7	4.000000	2.750000	1.3617957	0.1013846	1.3655645	4.2577699	-15.1480530
8	4.000000	3.000000	1.3628482	0.0585420	1.3641050	2.4596659	-15.3281778
9	4.000000	3.250000	1.3651172	0.0202888	1.3652680	0.8514839	-15.3184004
10	4.000000	3.500000	1.3686509	-0.0151041	1.3687342	-0.6322766	-15.3177953
11	4.000000	3.750000	1.3735757	-0.0492233	1.3744574	-2.0523678	-15.3258458
12	4.000000	4.000000	1.3800259	-0.0837204	1.3825631	-3.4716417	-15.3424374
13	4.000000	4.250000	1.3880660	-0.1205628	1.3932920	-4.9640644	-15.3678998
14	4.000000	4.500000	1.3974867	-0.1623469	1.4068850	-6.6263836	-15.4031280
15	4.000000	4.750000	1.4072733	-0.2126055	1.4232424	-8.5910592	-15.4497768
16	6.000000	2.750000	1.5612726	0.0217843	1.5614245	0.7993904	-14.3801399
17	6.000000	3.000000	1.5477889	0.0189751	1.5479052	0.7023809	-14.3749424
18	6.000000	3.250000	1.5404025	0.0133399	1.5404602	0.4961691	-14.3708774
19	6.000000	3.500000	1.5370586	0.0073103	1.5370760	0.2725000	-14.3683017
20	6.000000	3.750000	1.5366338	0.0019824	1.5366351	0.0739162	-14.3671628
21	6.000000	4.000000	1.5382992	-0.0019941	1.5383005	-0.0742733	-14.3671976
22	6.000000	4.250000	1.5412512	-0.0041784	1.5412569	-0.1553299	-14.3680094
23	6.000000	4.500000	1.5445618	-0.0043532	1.5445680	-0.1614816	-14.3691180
24	6.000000	4.750000	1.5471676	-0.0026951	1.5471699	-0.0998078	-14.3700316

\*01\* UNIT05, EOF.

REC= 00000 FIL= 00002

COMPRESSIBLE COMBYN APPROACH 5

TEST - 1

BASED ON BASIC DATA FROM 6/13/73 RUN NO. 189 AND 6/13/73 RUN NO. 189

VELOCITY	MACH	DYNAMIC PRESSURE	PRESSURE RATIO	DENSITY RATIO
CONTROL 7.000E+02	NO	INC.	COMP.	
BULK 7.000E+02	6.535E-01	5.827E+02	4.749E+02	7.506E-01
FREE 0.	0.	0.	7.247E-01	7.506E-01
STREAM			1.000E+00	1.000E+00

ALFAF	VINF/VC	VINF/VA	VC/VA	VSONIC	VSONICC
0.	0.	0.	1.000E+00	6.458E+02	1.019E+03

ISTAT	PSTAT	PSTATC	ASTAT	RHSTAT	WDOT	VIC
5.187E+02	2.116E+03	2.116E+03	1.116E+03	2.378E-03	0.	5.703E+02

TTOT	PTOT	PTOTC	ATOT	RHDTOT	THET	DEL
5.187E+02	2.116E+03	2.116E+03	1.116E+03	2.378E-03	1.000E+00	1.000E+00

XRI	YRIHUB	YRISHR	HUB-TIP RATIO	LND
6.000E+00	2.500E+00	5.000E+00	5.000E-01	1.000E+00

XTEST	YWING
-0.	0.

NT	NP	NCLO	NCHI	NHUBMX	NX	KND	KSKIP
1 102	1 24	16	24	40	-0	-0	
2 99	2 24						
V1	V2	A	B	C			VINFP
3.810E-01	1.545E+00	-4.900E+02	4.900E+02	0.			0.

1 OF 1 THETAS

THETA = 0. WDOTT = 1.78504E+01 VICT = 5.70305E+02 V3 = -1.42602E-01

HUB ON-BODY POINTS

I	X	Y	VP	VTHETA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC
1	0.	0.1250E+00	0.1164E+02	0.	0.1164E+02	0.2354E+03	0.	-0.7153E+01	-0.3393E-03	0.9769	0.9999
2	-0.	0.3750E+00	0.3492E+02	0.	0.3492E+02	0.2354E+03	0.	-0.6903E+01	-0.3054E-02	0.9769	0.9993
3	0.	0.8379E-02	0.6254E+00	0.	0.7415E+02	0.2503E+03	0.	-0.6652E+01	-0.1376E-01	0.9737	0.9969
4	0.	0.4613E-01	0.8560E+00	0.	0.1397E+03	0.2671E+03	0.	-0.6418E+01	-0.4866E-01	0.9698	0.9891
5	0.	0.1267E+00	0.1057E+01	0.	0.1984E+03	0.2869E+03	0.	-0.6202E+01	-0.9780E-01	0.9649	0.9781
6	0.	0.2473E+00	0.1236E+01	0.	0.2486E+03	0.3080E+03	0.	-0.5986E+01	-0.1529E+00	0.9591	0.9657
7	0.	0.3999E+00	0.1392E+01	0.	0.2896E+03	0.3285E+03	0.	-0.5768E+01	-0.2066E+03	0.9530	0.9536

8	0.5738E+00	0.1524E+01	0.3232E+03	0.0	0.3232E+03	0.3474E+03	0.0	-0.5549E+01	-0.2563E+00	0.9468	0.9425
9	0.7639E+00	0.1636E+01	0.3513E+03	0.0	0.3513E+03	0.3641E+03	0.0	-0.5329E+01	-0.3015E+00	0.9410	0.9323
10	0.9693E+00	0.1731E+01	0.3757E+03	0.0	0.3757E+03	0.3781E+03	0.0	-0.5103E+01	-0.3436E+00	0.9357	0.9229
11	0.1186E+01	0.1811E+01	0.3964E+03	0.0	0.3964E+03	0.3982E+03	0.0	-0.4871E+01	-0.3813E+00	0.9314	0.9144
12	0.1412E+01	0.1878E+01	0.4130E+03	0.0	0.4130E+03	0.4130E+03	0.0	-0.4636E+01	-0.4128E+00	0.9281	0.9074
13	0.1643E+01	0.1933E+01	0.4251E+03	0.0	0.4251E+03	0.4251E+03	0.0	-0.4398E+01	-0.4365E+00	0.9258	0.9021
14	0.1880E+01	0.1979E+01	0.4327E+03	0.0	0.4327E+03	0.4327E+03	0.0	-0.4157E+01	-0.4150E+00	0.9243	0.8987
15	0.2125E+01	0.2021E+01	0.4396E+03	0.0	0.4396E+03	0.4396E+03	0.0	-0.3908E+01	-0.4656E+00	0.9228	0.8955
16	0.2375E+01	0.2063E+01	0.4505E+03	0.0	0.4505E+03	0.4155E+03	0.0	-0.3655E+01	-0.488CE+00	0.9201	0.8905
17	0.2625E+01	0.2104E+01	0.4649E+03	0.0	0.4649E+03	0.4245E+03	0.0	-0.3402E+01	-0.5183E+00	0.9160	0.8837
18	0.2875E+01	0.2146E+01	0.4816E+03	0.0	0.4816E+03	0.4363E+03	0.0	-0.3148E+01	-0.5545E+00	0.9103	0.8756
19	0.3125E+01	0.2188E+01	0.5006E+03	0.0	0.5006E+03	0.4505E+03	0.0	-0.2895E+01	-0.5968E+00	0.9031	0.8661
20	0.3375E+01	0.2229E+01	0.5228E+03	0.0	0.5228E+03	0.4667E+03	0.0	-0.2641E+01	-0.6479E+00	0.8942	0.8546
21	0.3625E+01	0.2270E+01	0.5481E+03	0.0	0.5481E+03	0.4842E+03	0.0	-0.2388E+01	-0.7082E+00	0.8838	0.8411
22	0.3874E+01	0.2308E+01	0.5734E+03	0.0	0.5734E+03	0.5023E+03	0.0	-0.2136E+01	-0.7707E+00	0.8721	0.8270
23	0.4123E+01	0.2343E+01	0.5975E+03	0.0	0.5975E+03	0.5199E+03	0.0	-0.1884E+01	-0.8320E+00	0.8595	0.8133
24	0.4373E+01	0.2375E+01	0.6214E+03	0.0	0.6214E+03	0.5361E+03	0.0	-0.1632E+01	-0.8945E+00	0.8467	0.7993
25	0.4623E+01	0.2404E+01	0.6446E+03	0.0	0.6446E+03	0.5495E+03	0.0	-0.1380E+01	-0.9570E+00	0.8351	0.7853
26	0.4874E+01	0.2430E+01	0.6661E+03	0.0	0.6661E+03	0.5586E+03	0.0	-0.1129E+01	-0.1016E+00	0.8266	0.7720
27	0.5125E+01	0.2453E+01	0.6849E+03	0.0	0.6849E+03	0.5633E+03	0.0	-0.8767E+00	-0.1068E+00	0.8219	0.7602
28	0.5626E+01	0.2473E+01	0.7017E+03	0.0	0.7017E+03	0.5662E+03	0.0	-0.6252E+00	-0.1114E+00	0.8190	0.7495
29	0.5875E+01	0.2488E+01	0.7162E+03	0.0	0.7162E+03	0.5685E+03	0.0	-0.3743E+00	-0.1158E+00	0.8166	0.7401
30	0.6127E+01	0.2497E+01	0.7217E+03	0.0	0.7217E+03	0.5699E+03	0.0	-0.1245E+00	-0.1174E+00	0.8151	0.7366
31	0.6407E+01	0.2500E+01	0.7344E+03	0.0	0.7344E+03	0.5703E+03	0.0	-0.1270E+00	-0.1153E+00	0.8147	0.7413
32	0.6642E+01	0.2500E+01	0.7461E+03	0.0	0.7461E+03	0.5703E+03	0.0	-0.4065E+00	-0.1129E+00	0.8147	0.7467
33	0.6742E+01	0.2500E+01	0.7502E+03	0.0	0.7502E+03	0.5703E+03	0.0	-0.7419E+00	-0.1119E+00	0.8147	0.7489
34	0.7144E+01	0.2500E+01	0.7608E+03	0.0	0.7608E+03	0.5703E+03	0.0	-0.1144E+00	-0.1114E+00	0.8147	0.7501
35	0.7627E+01	0.2500E+01	0.6997E+03	0.0	0.6997E+03	0.5703E+03	0.0	-0.1627E+00	-0.1110E+00	0.8147	0.7508
36	0.8207E+01	0.2500E+01	0.6988E+03	0.0	0.6988E+03	0.5703E+03	0.0	-0.2207E+00	-0.1108E+00	0.8147	0.7514
37	0.8902E+01	0.2500E+01	0.6978E+03	0.0	0.6978E+03	0.5703E+03	0.0	-0.2902E+00	-0.1105E+00	0.8147	0.7520
38	0.9737E+01	0.2500E+01	0.6945E+03	0.0	0.6945E+03	0.5703E+03	0.0	-0.3737E+00	-0.1096E+00	0.8147	0.7561
39	0.1064E+02	0.2500E+01	0.6800E+03	0.0	0.6800E+03	0.5703E+03	0.0	-0.4644E+00	-0.1055E+00	0.8147	0.7633
40	0.1155E+02	0.2500E+01	0.3709E+03	0.0	0.3709E+03	0.5703E+03	0.0	-0.5548E+00	-0.3351E+00	0.8147	0.9248

SHROUD  
ON-BODY POINTS

I	X	Y	VP	VTHETA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC
41	0.1155E+02	0.5000E+01	-0.6884E+02	0.0	0.6884E+02	0.5703E+03	0.0	0.5548E+01	-0.1186E+00	0.8147	0.9973
42	0.1064E+02	0.5000E+01	-0.5681E+03	0.0	0.5681E+03	0.5703E+03	0.0	0.4644E+01	-0.7573E+00	0.8147	0.8301
43	0.9737E+01	0.5000E+01	-0.6379E+03	0.0	0.6379E+03	0.5703E+03	0.0	0.3737E+01	-0.9388E+00	0.8147	0.7893
44	0.8902E+01	0.5000E+01	-0.6680E+03	0.0	0.6680E+03	0.5703E+03	0.0	0.2902E+01	-0.1021E+00	0.8147	0.7708
45	0.8207E+01	0.5000E+01	-0.6795E+03	0.0	0.6795E+03	0.5703E+03	0.0	0.2207E+01	-0.1053E+00	0.8147	0.7636
46	0.7627E+01	0.5000E+01	-0.6856E+03	0.0	0.6856E+03	0.5703E+03	0.0	0.1627E+01	-0.1070E+00	0.8147	0.7598
47	0.7144E+01	0.5000E+01	-0.6893E+03	0.0	0.6893E+03	0.5703E+03	0.0	0.1144E+01	-0.1081E+00	0.8147	0.7575
48	0.6742E+01	0.5000E+01	-0.6919E+03	0.0	0.6919E+03	0.5703E+03	0.0	0.7419E+00	-0.1088E+00	0.8147	0.7558
49	0.6407E+01	0.5000E+01	-0.6941E+03	0.0	0.6941E+03	0.5703E+03	0.0	0.4065E+00	-0.1095E+00	0.8147	0.7544
50	0.6127E+01	0.5000E+01	-0.6965E+03	0.0	0.6965E+03	0.5703E+03	0.0	0.1270E+00	-0.1101E+00	0.8147	0.7529
51	0.5825E+01	0.5000E+01	-0.6974E+03	0.0	0.6974E+03	0.5699E+03	0.0	-0.1250E+00	-0.1104E+00	0.8151	0.7523
52	0.5625E+01	0.5000E+01	-0.6993E+03	0.0	0.6993E+03	0.5685E+03	0.0	-0.3750E+00	-0.1109E+00	0.8166	0.7511
53	0.5375E+01	0.5000E+01	-0.7036E+03	0.0	0.7036E+03	0.5662E+03	0.0	-0.6250E+00	-0.1122E+00	0.8190	0.7483
54	0.4879E+01	0.5000E+01	-0.7357E+03	0.0	0.7357E+03	0.5633E+03	0.0	-0.8750E+00	-0.1154E+00	0.8219	0.7410
55	0.4632E+01	0.5023E+01	-0.7312E+03	0.0	0.7312E+03	0.5499E+03	0.0	-0.1121E+00	-0.1215E+00	0.8265	0.7274
56	0.4373E+01	0.5058E+01	-0.6943E+03	0.0	0.6943E+03	0.5361E+03	0.0	-0.1369E+01	-0.1202E+00	0.8467	0.7303
57	0.4102E+01	0.5109E+01	-0.6445E+03	0.0	0.6445E+03	0.5185E+03	0.0	-0.1630E+01	-0.1095E+00	0.8467	0.7543
58	0.3821E+01	0.5172E+01	-0.5915E+03	0.0	0.5915E+03	0.4984E+03	0.0	-0.1906E+00	-0.9565E+00	0.8606	0.7854
59	0.3531E+01	0.5242E+01	-0.5413E+03	0.0	0.5413E+03	0.4774E+03	0.0	-0.2194E+01	-0.8165E+00	0.8747	0.8168
60	0.3236E+01	0.5315E+01	-0.4977E+03	0.0	0.4977E+03	0.4574E+03	0.0	-0.2493E+01	-0.6991E+00	0.8879	0.8448
61	0.2945E+01	0.5381E+01	-0.4629E+03	0.0	0.4629E+03	0.4400E+03	0.0	-0.2795E+01	-0.5902E+00	0.8994	0.8676
62	0.2945E+01	0.5381E+01	-0.4629E+03	0.0	0.4629E+03	0.4400E+03	0.0	-0.3094E+01	-0.5140E+00	0.9084	0.8847

63	0.2662E+01	0.5436E+01	-0.4383E+03	0.4261E+03	0.	-0.3383E+01	-0.4625E+00	0.9152	0.8961
64	0.2390E+01	0.5475E+01	-0.4254E+03	0.4159E+03	0.	-0.3658E+01	-0.4370E+00	0.9199	0.9019
65	0.2128E+01	0.5495E+01	-0.4280E+03	0.4096E+03	0.	-0.3920E+01	-0.4422E+00	0.9228	0.9008
66	0.1887E+01	0.5500E+01	-0.4524E+03	0.4061E+03	0.	-0.4161E+01	-0.4919E+00	0.9243	0.8896
67	0.1673E+01	0.5504E+01	-0.4879E+03	0.4031E+03	0.	-0.4375E+01	-0.5682E+00	0.9256	0.8725
68	0.1476E+01	0.5513E+01	-0.5157E+03	0.3989E+03	0.	-0.4572E+01	-0.6314E+00	0.9273	0.8583
69	0.1287E+01	0.5531E+01	-0.5392E+03	0.3932E+03	0.	-0.4762E+01	-0.6868E+00	0.9297	0.8459
70	0.1107E+01	0.5560E+01	-0.5569E+03	0.3856E+03	0.	-0.4945E+01	-0.7297E+00	0.9328	0.8363
71	0.9352E+00	0.5602E+01	-0.5675E+03	0.3761E+03	0.	-0.5122E+01	-0.7560E+00	0.9365	0.8304
72	0.7730E+00	0.5657E+01	-0.5705E+03	0.3648E+03	0.	-0.5293E+01	-0.7634E+00	0.9407	0.8287
73	0.6209E+00	0.5727E+01	-0.5649E+03	0.3519E+03	0.	-0.5460E+01	-0.7495E+00	0.9453	0.8318
74	0.4811E+00	0.5811E+01	-0.5514E+03	0.3379E+03	0.	-0.5624E+01	-0.7163E+00	0.9500	0.8393
75	0.3557E+00	0.5910E+01	-0.5297E+03	0.3230E+03	0.	-0.5783E+01	-0.6641E+00	0.9547	0.8510
76	0.2457E+00	0.6022E+01	-0.5005E+03	0.3078E+03	0.	-0.5940E+01	-0.5966E+00	0.9592	0.8661
77	0.1537E+00	0.6147E+01	-0.4645E+03	0.2923E+03	0.	-0.6094E+01	-0.5174E+00	0.9634	0.8839
78	0.8191E-01	0.6283E+01	-0.4219E+03	0.2773E+03	0.	-0.6245E+01	-0.4303E+00	0.9673	0.9034
79	0.3236E-01	0.6427E+01	-0.3725E+03	0.2628E+03	0.	-0.6401E+01	-0.3375E+00	0.9708	0.9242
80	0.6693E-02	0.6575E+01	-0.3092E+03	0.2493E+03	0.	-0.6552E+01	-0.2349E+00	0.9739	0.9473
81	0.	0.6741E+01	-0.2466E+03	0.2354E+03	0.	-0.6718E+01	-0.1505E+00	0.9769	0.9662
82	0.	0.6942E+01	-0.2076E+03	0.2184E+03	0.	-0.6919E+01	-0.1070E+00	0.9802	0.9760
83	0.	0.7183E+01	-0.1771E+03	0.2003E+03	0.	-0.7160E+01	-0.7804E-01	0.9834	0.9825
84	0.	0.7472E+01	-0.1516E+03	0.1811E+03	0.	-0.7449E+01	-0.5730E-01	0.9865	0.9871
85	0.	0.7819E+01	-0.1296E+03	0.1613E+03	0.	-0.7794E+01	-0.4193E-01	0.9894	0.9906
86	0.	0.8236E+01	-0.1103E+03	0.1411E+03	0.	-0.8213E+01	-0.3039E-01	0.9919	0.9932
87	0.	0.8736E+01	-0.9321E+02	0.1212E+03	0.	-0.8712E+01	-0.2173E-01	0.9940	0.9951
88	0.	0.9335E+01	-0.7811E+02	0.1020E+03	0.	-0.9312E+01	-0.1526E-01	0.9958	0.9966
89	0.	0.1006E+02	-0.6479E+02	0.8399E+02	0.	-0.1003E+02	-0.1051E-01	0.9972	0.9976
90	0.	0.1092E+02	-0.5320E+02	0.6760E+02	0.	-0.1090E+02	-0.7085E-02	0.9982	0.9984
91	0.	0.1187E+02	-0.4267E+02	0.5418E+02	0.	-0.1184E+02	-0.4560E-02	0.9988	0.9990
92	0.	0.1282E+02	-0.3454E+02	0.4405E+02	0.	-0.1280E+02	-0.2987E-02	0.9992	0.9993
93	0.	0.1378E+02	-0.2803E+02	0.3630E+02	0.	-0.1376E+02	-0.1968E-02	0.9995	0.9996
94	0.	0.1474E+02	-0.2259E+02	0.3028E+02	0.	-0.1471E+02	-0.1278E-02	0.9996	0.9997
95	0.	0.1569E+02	-0.1778E+02	0.2553E+02	0.	-0.1567E+02	-0.7922E-03	0.9997	0.9998
96	0.	0.1665E+02	-0.1326E+02	0.2172E+02	0.	-0.1663E+02	-0.4408E-03	0.9998	0.9999
97	0.	0.1761E+02	-0.8558E+01	0.1864E+02	0.	-0.1758E+02	-0.1835E-03	0.9999	1.0000
98	0.	0.1856E+02	-0.2714E+01	0.1612E+02	0.	-0.1854E+02	-0.1844E-04	0.9999	1.0000
99	0.	0.1952E+02	0.8468E+01	0.1403E+02	0.	-0.1950E+02	-0.1794E-03	1.0000	1.0000

## OFF-BODY POINTS (RAKES)

I	COORDINATES			VELOCITIES										PRESS. RATIO	
	AXIAL	RADIAL	Y	AXIAL	VX	RADIAL	VY	CIRCUMFNTL	RESULTANT	MERIDIONAL	CHORDWISE	SPANWISE	VSPAN	RHOBR	PSOPTC
1	2.0000E+00	1.9996E+00	4.2935E+02	7.3613E+01	-0.	4.2935E+02	7.3613E+01	-0.	4.3561E+02	4.3561E+02	7.3613E+01	0.	0.	0.9237	0.8973
2	2.0000E+00	2.5000E+00	4.2841E+02	3.9402E+01	0.	4.3022E+02	3.9402E+01	0.	4.3022E+02	4.3022E+02	3.9402E+01	0.	0.	0.9237	0.8998
3	2.0000E+00	3.0000E+00	4.3189E+02	7.9956E+00	0.	4.3196E+02	7.9956E+00	0.	4.3196E+02	4.3196E+02	7.9956E+00	0.	0.	0.9237	0.8964
4	2.0000E+00	4.0000E+00	4.3720E+02	-1.8046E+01	0.	4.3757E+02	-1.8046E+01	0.	4.3757E+02	4.3757E+02	-1.8046E+01	0.	0.	0.9237	0.8931
5	2.0000E+00	4.0000E+00	4.4322E+02	-3.8016E+01	0.	4.4485E+02	-3.8016E+01	0.	4.4485E+02	4.4485E+02	-3.8016E+01	0.	0.	0.9237	0.8900
6	2.0000E+00	4.5000E+00	4.4893E+02	-4.9511E+01	0.	4.5165E+02	-4.9511E+01	0.	4.5165E+02	4.5165E+02	-4.9511E+01	0.	0.	0.9237	0.8890
7	2.0000E+00	5.0000E+00	4.5146E+02	-4.5776E+01	0.	4.5377E+02	-4.5776E+01	0.	4.5377E+02	4.5377E+02	-4.5776E+01	0.	0.	0.9237	0.8890
8	2.0000E+00	5.4981E+00	4.3876E+02	-1.0129E+01	0.	4.3887E+02	-1.0129E+01	0.	4.3887E+02	4.3887E+02	-1.0129E+01	0.	0.	0.8658	0.8225
9	2.0000E+00	2.3258E+00	5.8001E+02	8.0848E+01	0.	5.8562E+02	8.0848E+01	0.	5.8562E+02	5.8562E+02	8.0848E+01	0.	0.	0.8658	0.8227
10	2.0000E+00	2.7500E+00	5.7990E+02	4.2780E+01	0.	5.8148E+02	4.2780E+01	0.	5.8148E+02	5.8148E+02	4.2780E+01	0.	0.	0.8658	0.8222
11	2.0000E+00	3.0000E+00	5.8054E+02	2.4419E+01	0.	5.8105E+02	2.4419E+01	0.	5.8105E+02	5.8105E+02	2.4419E+01	0.	0.	0.8658	0.8210
12	2.0000E+00	3.2500E+00	5.8192E+02	8.0853E+00	0.	5.8198E+02	8.0853E+00	0.	5.8198E+02	5.8198E+02	8.0853E+00	0.	0.	0.8658	0.8192
13	2.0000E+00	3.5000E+00	5.8404E+02	-6.9686E+00	0.	5.8408E+02	-6.9686E+00	0.	5.8408E+02	5.8408E+02	-6.9686E+00	0.	0.	0.8658	0.8166
14	2.0000E+00	3.7500E+00	5.8695E+02	-2.1428E+01	0.	5.8734E+02	-2.1428E+01	0.	5.8734E+02	5.8734E+02	-2.1428E+01	0.	0.	0.8658	0.8132
15	2.0000E+00	4.0000E+00	5.9073E+02	-3.6006E+01	0.	5.9182E+02	-3.6006E+01	0.	5.9182E+02	5.9182E+02	-3.6006E+01	0.	0.	0.8658	0.8089
16	2.0000E+00	4.2500E+00	5.9546E+02	-1.1556E+01	0.	5.9768E+02	-1.1556E+01	0.	5.9768E+02	5.9768E+02	-1.1556E+01	0.	0.	0.8658	0.8036
17	2.0000E+00	4.5000E+00	6.0111E+02	-6.9222E+01	0.	6.0508E+02	-6.9222E+01	0.	6.0508E+02	6.0508E+02	-6.9222E+01	0.	0.	0.8658	0.7973
18	2.0000E+00	4.7500E+00	6.0733E+02	-9.0581E+01	0.	6.1405E+02	-9.0581E+01	0.	6.1405E+02	6.1405E+02	-9.0581E+01	0.	0.	0.8658	0.7939
19	2.0000E+00	5.1310E+00	6.1001E+02	-1.3480E+02	0.	6.2473E+02	-1.3480E+02	0.	6.2473E+02	6.2473E+02	-1.3480E+02	0.	0.	0.8149	0.7466
20	2.0000E+00	2.4990E+00	7.1806E+02	7.5389E+00	0.	7.1810E+02	7.5389E+00	0.	7.1810E+02	7.1810E+02	7.5389E+00	0.	0.	0.8149	0.7494
21	2.0000E+00	2.7500E+00	7.0928E+02	9.9827E+00	0.	7.0935E+02	9.9827E+00	0.	7.0935E+02	7.0935E+02	9.9827E+00	0.	0.	0.8149	0.7520
22	2.0000E+00	3.0000E+00	7.0188E+02	8.728E+00	0.	7.0194E+02	8.728E+00	0.	7.0194E+02	7.0194E+02	8.728E+00	0.	0.	0.8149	0.7532
23	2.0000E+00	3.2500E+00	6.9783E+02	6.3117E+00	0.	6.9786E+02	6.3117E+00	0.	6.9786E+02	6.9786E+02	6.3117E+00	0.	0.	0.8149	0.7528
24	2.0000E+00	3.5000E+00	6.9599E+02	3.6672E+00	0.	6.9600E+02	3.6672E+00	0.	6.9600E+02	6.9600E+02	3.6672E+00	0.	0.	0.8149	0.7517
25	2.0000E+00	3.7500E+00	6.9574E+02	1.3361E+00	0.	6.9574E+02	1.3361E+00	0.	6.9574E+02	6.9574E+02	1.3361E+00	0.	0.	0.8149	0.7506
26	2.0000E+00	4.0000E+00	6.9663E+02	-4.0146E-01	0.	6.9663E+02	-4.0146E-01	0.	6.9663E+02	6.9663E+02	-4.0146E-01	0.	0.	0.8149	0.7494
27	2.0000E+00	4.2500E+00	6.9822E+02	-1.3643E+00	0.	6.9823E+02	-1.3643E+00	0.	6.9823E+02	6.9823E+02	-1.3643E+00	0.	0.	0.8149	0.7494
28	2.0000E+00	4.5000E+00	7.0006E+02	-1.4762E+00	0.	7.0006E+02	-1.4762E+00	0.	7.0006E+02	7.0006E+02	-1.4762E+00	0.	0.	0.8149	0.7494
29	2.0000E+00	4.7500E+00	7.0161E+02	-8.5257E-01	0.	7.0161E+02	-8.5257E-01	0.	7.0161E+02	7.0161E+02	-8.5257E-01	0.	0.	0.8149	0.7494
30	2.0000E+00	5.0000E+00	6.9685E+02	0.	-0.	6.9685E+02	0.	-0.	6.9685E+02	6.9685E+02	0.	-0.	0.	0.8149	0.7526

I	COORDINATES			ANGLES										PRESS. RATIO	
	AXIAL	RADIAL	Y	AXIAL	VBRI	NEW	CP	MERIDIONAL	FLOW	UNDERTURN	SPANWISE	SWIRL	PHI	QFRACT	PSOPTC
1	2.0000E+00	1.9996E+00	4.2935E+02	7.3613E+01	-0.	4.2935E+02	7.3613E+01	-0.	4.3561E+02	4.3561E+02	7.3613E+01	0.	0.	0.9237	0.8973
2	2.0000E+00	2.5000E+00	4.2841E+02	3.9402E+01	0.	4.3022E+02	3.9402E+01	0.	4.3022E+02	4.3022E+02	3.9402E+01	0.	0.	0.9237	0.8998
3	2.0000E+00	3.0000E+00	4.3189E+02	7.9956E+00	0.	4.3196E+02	7.9956E+00	0.	4.3196E+02	4.3196E+02	7.9956E+00	0.	0.	0.9237	0.8964
4	2.0000E+00	4.0000E+00	4.3720E+02	-1.8046E+01	0.	4.3757E+02	-1.8046E+01	0.	4.3757E+02	4.3757E+02	-1.8046E+01	0.	0.	0.9237	0.8931
5	2.0000E+00	4.0000E+00	4.4322E+02	-3.8016E+01	0.	4.4485E+02	-3.8016E+01	0.	4.4485E+02	4.4485E+02	-3.8016E+01	0.	0.	0.9237	0.8900
6	2.0000E+00	4.5000E+00	4.4893E+02	-4.9511E+01	0.	4.5165E+02	-4.9511E+01	0.	4.5165E+02	4.5165E+02	-4.9511E+01	0.	0.	0.9237	0.8890
7	2.0000E+00	5.0000E+00	4.5146E+02	-4.5776E+01	0.	4.5377E+02	-4.5776E+01	0.	4.5377E+02	4.5377E+02	-4.5776E+01	0.	0.	0.9237	0.8890
8	2.0000E+00	5.4981E+00	4.3876E+02	-1.0129E+01	0.	4.3887E+02	-1.0129E+01	0.	4.3887E+02	4.3887E+02	-1.0129E+01	0.	0.	0.8658	0.8225
9	2.0000E+00	2.3258E+00	5.8001E+02	8.0848E+01	0.	5.8562E+02	8.0848E+01	0.	5.8562E+02	5.8562E+02	8.0848E+01	0.	0.	0.8658	0.8227
10	2.0000E+00	2.7500E+00	5.7990E+02	4.2780E+01	0.	5.8148E+02	4.2780E+01	0.	5.8148E+02	5.8148E+02	4.2780E+01	0.	0.	0.8658	0.8222
11	2.0000E+00	3.0000E+00	5.8054E+02	2.4419E+01	0.	5.8105E+02	2.4419E+01	0.	5.8105E+02	5.8105E+02	2.4419E+01	0.	0.	0.8658	0.8210
12	2.0000E+00	3.2500E+00	5.8192E+02	8.0853E+00	0.	5.8198E+02	8.0853E+00	0.	5.8198E+02	5.8198E+02	8.0853E+00	0.	0.	0.8658	0.8192
13	2.0000E+00	3.5000E+00	5.8404E+02	-6.9686E+00	0.	5.8408E+02	-6.9686E+00	0.	5.8408E+02	5.8408E+02	-6.9686E+00	0.	0.	0.8658	0.8166
14	2.0000E+00	3.7500E+00	5.8695E+02	-2.1428E+01	0.	5.8734E+02	-2.1428E+01	0.	5.8734E+02	5.8734E+02	-2.1428E+01	0.	0.	0.8658	0.8132
15	2.0000E+00	4.0000E+00	5.9073E+02	-3.6006E+01	0.	5.9182E+02	-3.6006E+01	0.	5.9182E+02	5.9182E+02	-3.6006E+01	0.	0.	0.8658	0.8089
16	2.0000E+00	4.2500E+00	5.9546E+02	-1.1556E+01	0.	5.9768E+02	-1.1556E+01	0.	5.9768E+02	5.9768E+02	-1.1556E+01	0.	0.	0.8658	0.8036
17	2.0000E+00	4.5000E+00	6.0111E+02	-6.9222E+01	0.	6.0508E+02	-6.9222E+01	0.	6.0508E+02	6.0508E+02	-6.9222E+01	0.	0.	0.8658	0.7973
18	2.0000E+00	4.7500E+00	6.0733E+02	-9.0581E+01	0.	6.1405E+02	-9.0581E+01	0.	6.1405E+02	6.1405E+02	-9.0581E+01	0.	0.	0.8658	0.7939
19	2.0000E+00	5.1310E+00	6.1001E+02	-1.3480E+02	0.	6.2473E+02	-1.3480E+02	0.	6.2473E+02	6.2473E+02	-1.3480E+02	0.	0.	0.8658	0.7939
20	2.0000E+00	2.4990E+00	7.1806E+02	7.5389E+00	0.	7.1810E+02	7.5389E+00	0.	7.1810E+02	7.1810E+02	7.5389E+00	0.	0.	0.8149	0.7466
21	2.0000E+00	2.7500E+00	7.0928E+02	9.9827E+00	0.	7.0935E+02	9.9827E+00	0.	7.0935E+02	7.0935E+02	9.9827E+00	0.	0.	0.8149	0.7494
22	2.0000E+00	3.0000E+00	7.0188E+02	8.728E+00	0.	7.0194E+02	8.728E+00	0.	7.0194E+02	7.0194E+02	8.728E+00	0.	0.	0.8149	0.7520
23	2.0000E+00	3.2500E+00	6.9783E+02	6.3117E+00	0.	6.9786E+02	6.3117E+00	0.	6.9786E+02	6.9786E+02	6.3117E+00	0.	0.	0.8149	0.7532
24	2.0000E+00	3.5000E+00	6.9599E+02	3.6672E+00	0.	6.9600E+02	3.6672E+00	0.	6.9600E+02	6.9600E+02	3.6672E+00	0.	0.	0.8149	0.7528
25	2.0000E+00	3.7500E+00	6.9574E+02	1.3361E+00	0.	6.9574E+02	1.3361E+00	0.	6.9574E+02	6.9574E+02	1.3361E+00	0.	0.	0.8149	0.7532
26	2.0000E+00	4.0000E+00	6.9663E+02	-4.0146E-01	0.	6.9663E+02	-4.0146E-01	0.	6.9663E+02	6.9663E+02	-4.0146E-01	0.	0.	0.8149	0.7528
27	2.0000E+00	4.2500E+00	6.9822E+02	-1.3643E+00	0.	6.9823E+02	-1.3643E+00	0.	6.9823E+02	6.9823E+02	-1.3643E+00	0.	0.	0.8149	0.7517
28	2.0000E+00	4.5000E+00	7.0006E+02	-1.4762E+00	0.	7.0006E+02	-1.4762E+00	0.	7.0006E+02	7.0006E+02	-1.4762E+00	0.	0.	0.8149	0.7506
29	2.0000E+00	4.7500E+00	7.0161E+02	-8.5257E-01	0.	7.0161E+02	-8.5257E-01	0.	7.0161E+02	7.0161E+02	-8.5257E-01	0.	0.	0.8149	0.7494
30	2.0000E+00	5.0000E+00	6.9685E+02	0.	-0.	6.9685E+02	0.	-0.	6.9685E+02	6.9685E+02	0.	-0.	0.	0.8149	0.7526

16	6.0000E+00	2.4990E+00	-1.1635E+00	6.0152E-01	-0.	6.0152E-01	0.	-0.	0.
17	6.0000E+00	2.7500E+00	-1.1382E+00	7.0152E-01	0.	8.0635E-01	0.	0.	7.1016E-02
18	6.0000E+00	3.0000E+00	-1.1169E+00	7.1692E-01	0.	7.1692E-01	0.	0.	1.4800E-01
19	6.0000E+00	3.2500E+00	-1.1053E+00	5.1821E-01	0.	5.1821E-01	0.	0.	2.3131E-01
20	6.0000E+00	3.5000E+00	-1.1000E+00	3.0189E-01	0.	3.0189E-01	0.	0.	3.2106E-01
21	6.0000E+00	3.7500E+00	-1.0992E+00	1.1003E-01	0.	1.1003E-01	0.	0.	4.1739E-01
22	6.0000E+00	4.0000E+00	-1.1018E+00	-3.3019E-02	0.	-3.3019E-02	-0.	0.	5.2038E-01
23	6.0000E+00	4.2500E+00	-1.1063E+00	-1.1195E-01	0.	-1.1195E-01	-0.	0.	6.3014E-01
24	6.0000E+00	4.5000E+00	-1.1115E+00	-1.2082E-01	0.	-1.2082E-01	-0.	0.	7.4671E-01
	6.0000E+00	4.7500E+00	-1.1160E+00	-6.9623E-02	0.	-6.9623E-02	-0.	0.	8.7011E-01
	6.0000E+00	5.0000E+00	-1.1024E+00	0.	-0.	-0.	0.	-0.	1.0000E+00

# RELATIVE ROTOR INLET DATA

X = 6.0000 UTIP = 900.0000

Y	U	VZPRIME	VPRIM	MPRIME	BETAPR	VZPRST	VPRST	MPRS	BETAPS
2.4990E+00	4.4982E+02	-4.4982E+02	8.4735E+02	7.9286E-01	-3.2063E+01	-4.4982E+02	8.4735E+02	7.9286E-01	-3.2063E+01
2.7500E+00	4.9500E+02	-4.9500E+02	8.5499E+02	8.0847E-01	-3.4908E+01	-4.9500E+02	8.5499E+02	8.0847E-01	-3.4908E+01
3.0000E+00	5.4000E+02	-5.4000E+02	8.8562E+02	8.2700E-01	-3.7571E+01	-5.4000E+02	8.8562E+02	8.2700E-01	-3.7571E+01
3.2500E+00	5.8500E+02	-5.8500E+02	9.1062E+02	8.4993E-01	-3.9972E+01	-5.8500E+02	9.1062E+02	8.4993E-01	-3.9972E+01
3.5000E+00	6.3000E+02	-6.3000E+02	9.3878E+02	8.7601E-01	-4.2151E+01	-6.3000E+02	9.3878E+02	8.7601E-01	-4.2151E+01
3.7500E+00	6.7500E+02	-6.7500E+02	9.6937E+02	9.0453E-01	-4.4133E+01	-6.7500E+02	9.6937E+02	9.0453E-01	-4.4133E+01
4.0000E+00	7.2000E+02	-7.2000E+02	1.0018E+03	9.3493E-01	-4.5945E+01	-7.2000E+02	1.0018E+03	9.3493E-01	-4.5945E+01
4.2500E+00	7.6500E+02	-7.6500E+02	1.0357E+03	9.6674E-01	-4.7613E+01	-7.6500E+02	1.0357E+03	9.6674E-01	-4.7613E+01
4.5000E+00	8.1000E+02	-8.1000E+02	1.0706E+03	9.9951E-01	-4.9164E+01	-8.1000E+02	1.0706E+03	9.9951E-01	-4.9164E+01
4.7500E+00	8.5500E+02	-8.5500E+02	1.1060E+03	1.0328E+00	-5.0628E+01	-8.5500E+02	1.1060E+03	1.0328E+00	-5.0628E+01
5.0000E+00	9.0000E+02	-9.0000E+02	1.1382E+03	1.0622E+00	-5.2250E+01	-9.0000E+02	1.1382E+03	1.0622E+00	-5.2250E+01

# RAKE WEIGHT FLOW DATA

I	X	(Q(I)-QBARI)/QBAR	QS TOT	QFR
1	2.0000E+00	-1.0433E-03	1.7834E+01	1.0000E+00
2	4.0000E+00	6.3221E-04	1.7864E+01	1.0000E+00
3	6.0000E+00	0.	1.7853E+01	1.0000E+00

# STREAMLINES

X	YSTRM
2.0000E-02	2.12664E+00
4.0000E-02	2.24897E+00
6.0000E-02	2.36656E+00
8.0000E-02	2.47940E+00
1.0000E-01	2.58406E+00
1.2000E-01	2.68495E+00
1.4000E-01	2.78305E+00
1.6000E-01	2.87836E+00
1.8000E-01	2.97088E+00
2.0000E-01	3.05869E+00
2.2000E-01	3.14367E+00
2.4000E-01	3.22689E+00
2.6000E-01	3.30836E+00
2.8000E-01	3.38808E+00
3.0000E-01	3.46604E+00
3.2000E-01	3.54116E+00
3.4000E-01	3.61412E+00
3.6000E-01	3.68591E+00

3.80000E-01	3.75655E+00
4.00000E-01	3.82603E+00
4.20000E-01	3.89434E+00
4.40000E-01	3.96149E+00
4.60000E-01	4.02688E+00
4.80000E-01	4.09053E+00
5.00000E-01	4.15338E+00
5.20000E-01	4.21546E+00
5.40000E-01	4.27674E+00
5.60000E-01	4.33724E+00
5.80000E-01	4.39695E+00
6.00000E-01	4.45588E+00
6.20000E-01	4.51369E+00
6.40000E-01	4.56988E+00
6.60000E-01	4.62559E+00
6.80000E-01	4.68081E+00
7.00000E-01	4.73554E+00
7.20000E-01	4.78978E+00
7.40000E-01	4.84354E+00
7.60000E-01	4.89681E+00
7.80000E-01	4.94960E+00
8.00000E-01	5.00190E+00
8.20000E-01	5.05371E+00
8.40000E-01	5.10503E+00
8.60000E-01	5.15587E+00
8.80000E-01	5.20622E+00
9.00000E-01	5.25608E+00
9.20000E-01	5.30546E+00
9.40000E-01	5.35435E+00
9.60000E-01	5.40275E+00
9.80000E-01	5.45067E+00
1.00000E+00	5.49810E+00

X = 4.000

QSTRM	YSTRM
2.00000E-02	2.41427E+00
4.00000E-02	2.50038E+00
6.00000E-02	2.58413E+00
8.00000E-02	2.66554E+00
1.00000E-01	2.74461E+00
1.20000E-01	2.82059E+00
1.40000E-01	2.89479E+00
1.60000E-01	2.96729E+00
1.80000E-01	3.03779E+00
2.00000E-01	3.10661E+00
2.20000E-01	3.17409E+00
2.40000E-01	3.24023E+00
2.60000E-01	3.30467E+00
2.80000E-01	3.36795E+00
3.00000E-01	3.43015E+00
3.20000E-01	3.49127E+00
3.40000E-01	3.55102E+00
3.60000E-01	3.60982E+00
3.80000E-01	3.66773E+00
4.00000E-01	3.72476E+00
4.20000E-01	3.78073E+00
4.40000E-01	3.83579E+00
4.60000E-01	3.89012E+00
4.80000E-01	3.94371E+00
5.00000E-01	3.99657E+00

5.20000E-01	4.04847E+00
5.40000E-01	4.09973E+00
5.60000E-01	4.15038E+00
5.80000E-01	4.20041E+00
6.00000E-01	4.24983E+00
6.20000E-01	4.29841E+00
6.40000E-01	4.34648E+00
6.60000E-01	4.39403E+00
6.80000E-01	4.44106E+00
7.00000E-01	4.48757E+00
7.20000E-01	4.53335E+00
7.40000E-01	4.57864E+00
7.60000E-01	4.62352E+00
7.80000E-01	4.66801E+00
8.00000E-01	4.71210E+00
8.20000E-01	4.75579E+00
8.40000E-01	4.79908E+00
8.60000E-01	4.84197E+00
8.80000E-01	4.88446E+00
9.00000E-01	4.92656E+00
9.20000E-01	4.96825E+00
9.40000E-01	5.00955E+00
9.60000E-01	5.05044E+00
9.80000E-01	5.09094E+00
1.00000E+00	5.13104E+00

X = 6.000

QSTRM	YSTRM
2.00000E-02	2.57166E+00
4.00000E-02	2.64278E+00
6.00000E-02	2.71235E+00
8.00000E-02	2.78011E+00
1.00000E-01	2.84625E+00
1.20000E-01	2.91117E+00
1.40000E-01	2.97485E+00
1.60000E-01	3.03706E+00
1.80000E-01	3.09807E+00
2.00000E-01	3.15807E+00
2.20000E-01	3.21708E+00
2.40000E-01	3.27493E+00
2.60000E-01	3.33170E+00
2.80000E-01	3.38766E+00
3.00000E-01	3.44281E+00
3.20000E-01	3.49713E+00
3.40000E-01	3.55038E+00
3.60000E-01	3.60294E+00
3.80000E-01	3.65482E+00
4.00000E-01	3.70603E+00
4.20000E-01	3.75653E+00
4.40000E-01	3.80617E+00
4.60000E-01	3.85524E+00
4.80000E-01	3.90376E+00
5.00000E-01	3.95171E+00
5.20000E-01	3.99910E+00
5.40000E-01	4.04573E+00
5.60000E-01	4.09188E+00
5.80000E-01	4.13756E+00
6.00000E-01	4.18277E+00
6.20000E-01	4.22751E+00
6.40000E-01	4.27168E+00



6.6000E-01  
6.8000E-01  
7.0000E-01  
7.2000E-01  
7.4000E-01  
7.6000E-01  
7.8000E-01  
8.0000E-01  
8.2000E-01  
8.4000E-01  
8.6000E-01  
8.8000E-01  
9.0000E-01  
9.2000E-01  
9.4000E-01  
9.6000E-01  
9.8000E-01  
1.0000E+00

4.3153E+00  
4.3585E+00  
4.4014E+00  
4.4439E+00  
4.4859E+00  
4.5275E+00  
4.5685E+00  
4.6094E+00  
4.6499E+00  
4.6901E+00  
4.7298E+00  
4.7691E+00  
4.8087E+00  
4.8476E+00  
4.8862E+00  
4.9244E+00  
4.9623E+00  
5.0000E+00

## COMPRESSIBLE COMBYN APPROACH 5

TEST-1

BASED ON BASIC DATA FROM 6/13/73 RUN NO. 189 AND 6/13/73 RUN NO. 189

	VELOCITY	MACH	DYNAMIC PRESSURE	PRESSURE RATIO	DENSITY RATIO
		NO	INC.	INC.	
CONTROL	7.000E+02	6.535E-01	5.803E+02	4.749E+02	7.506E-01
BULK	7.000E+02	6.535E-01	5.803E+02	4.749E+02	7.506E-01
FREE	1.000E+02	8.968E-02	1.184E+01	1.185E+01	9.944E-01
STREAM					9.960E-01

	ALFAF	VINF/VC	VINF/VA	VC/VA	VSONIC	VSONICC
0.		1.429E-01	1.429E-01	1.000E+00	6.458E+02	1.019E+03

	TSTAT	PSTAT	PSTATC	ASTAT	RHUSTAT	WDOT	VIC
5.178E+02	2.104E+03	2.104E+03	1.115E+03	2.369E-03	0.		5.703E+02

	TTOT	PTCT	PTOTC	ATOT	RHOTOT	THET	DEL
5.187E+02	2.116E+03	2.116E+03	1.116E+03	2.378E-03	1.000E+00		1.000E+00

	XRI	YRIHUB	YRISHR	HUB-TIP RATIO	LND
6.000E+00	2.500E+00	5.000E+00	5.000E-01	1.030E+00	

	XTEST	YWING
0.		0.

	NT	NP	NCLD	NCHI	NHURMX	NX	KND	KSKIP
1	102	1	24	24	40	-0	-0	1
2	99	2	24	24	40	-0	-0	1
3	810E-01	1.545E+00	-4.900E+02	-4.900E+02	4.900E+02	9.960E+01	9.960E+01	9.960E+01

1 OF 3 THETAS

THETA = 0. WDOTT = 1.740508E+01 VICT = 5.56102E+02 V3 = -1.42602E-01

HUB  
ON-BODY POINTS

I	X	Y	VP	VTHETA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC
1	0.	0.1250E+00	0.1006E+03	0.	0.1006E+03	0.2295E+03	0.	-0.7153E+01	-0.3164E-03	0.9780	0.9943
2	-0.	0.3750E+00	0.1269E+03	0.	0.1269E+03	0.2295E+03	0.	-0.6903E+01	-0.1521E-01	0.9780	0.9910
3	0.8379E-02	0.6254E+00	0.1716E+03	0.	0.1716E+03	0.2440E+03	0.	-0.6652E+01	-0.4834E-01	0.9750	0.9835
4	0.4613E-01	0.8560E+00	0.2385E+03	0.	0.2385E+03	0.2604E+03	0.	-0.6418E+01	-0.1158E+00	0.9714	0.9684
5	0.1267E+00	0.1057E+01	0.2878E+03	0.	0.2878E+03	0.2798E+03	0.	-0.6202E+01	-0.1790E+00	0.9667	0.9542
6	0.2473E+00	0.1236E+01	0.3225E+03	0.	0.3225E+03	0.3003E+03	0.	-0.5986E+01	-0.2301E+00	0.9613	0.9428
7	0.3999E+00	0.1392E+01	0.3462E+03	0.	0.3462E+03	0.3203E+03	0.	-0.5768E+01	-0.2681E+00	0.9555	0.9342

8	0.5738E+00	0.1524E+01	0.3636E+03	0.0	0.3387E+03	0.0	-0.5549E+01	-0.2975E+00	0.9497	0.9276
9	0.7639E+00	0.1636E+01	0.3773E+03	0.0	0.3550E+03	0.0	-0.5329E+01	-0.3215E+00	0.9442	0.9223
10	0.9693E+00	0.1731E+01	0.3892E+03	0.0	0.3687E+03	0.0	-0.5103E+01	-0.3431E+00	0.9393	0.9174
11	0.1186E+01	0.1811E+01	0.3994E+03	0.0	0.3795E+03	0.0	-0.4871E+01	-0.3620E+00	0.9352	0.9131
12	0.1412E+01	0.1878E+01	0.4077E+03	0.0	0.3873E+03	0.0	-0.4636E+01	-0.3776E+00	0.9321	0.9097
13	0.1643E+01	0.1933E+01	0.4134E+03	0.0	0.3925E+03	0.0	-0.4398E+01	-0.3885E+00	0.9300	0.9072
14	0.1880E+01	0.1979E+01	0.4164E+03	0.0	0.3958E+03	0.0	-0.4157E+01	-0.3944E+00	0.9286	0.9059
15	0.2125E+01	0.2021E+01	0.4206E+03	0.0	0.3993E+03	0.0	-0.3908E+01	-0.4026E+00	0.9272	0.9041
16	0.2375E+01	0.2063E+01	0.4294E+03	0.0	0.4052E+03	0.0	-0.3655E+01	-0.4201E+00	0.9248	0.9001
17	0.2625E+01	0.2104E+01	0.4422E+03	0.0	0.4140E+03	0.0	-0.3402E+01	-0.4458E+00	0.9208	0.8943
18	0.2875E+01	0.2146E+01	0.4575E+03	0.0	0.4255E+03	0.0	-0.3148E+01	-0.4777E+00	0.9155	0.8872
19	0.3125E+01	0.2188E+01	0.4753E+03	0.0	0.4393E+03	0.0	-0.2895E+01	-0.5158E+00	0.9088	0.8787
20	0.3375E+01	0.2229E+01	0.4964E+03	0.0	0.4551E+03	0.0	-0.2641E+01	-0.5624E+00	0.9036	0.8682
21	0.3625E+01	0.2270E+01	0.5203E+03	0.0	0.4722E+03	0.0	-0.2388E+01	-0.6175E+00	0.8910	0.8558
22	0.3874E+01	0.2308E+01	0.5446E+03	0.0	0.4898E+03	0.0	-0.2136E+01	-0.6747E+00	0.8803	0.8430
23	0.4123E+01	0.2343E+01	0.5676E+03	0.0	0.5070E+03	0.0	-0.1884E+01	-0.7313E+00	0.8688	0.8303
24	0.4373E+01	0.2375E+01	0.5906E+03	0.0	0.5228E+03	0.0	-0.1632E+01	-0.7893E+00	0.8573	0.8173
25	0.4623E+01	0.2404E+01	0.6131E+03	0.0	0.5358E+03	0.0	-0.1380E+01	-0.8477E+00	0.8470	0.8042
26	0.4874E+01	0.2430E+01	0.6341E+03	0.0	0.5447E+03	0.0	-0.1129E+01	-0.9036E+00	0.8394	0.7916
27	0.5125E+01	0.2453E+01	0.6530E+03	0.0	0.5493E+03	0.0	-0.8767E+00	-0.9549E+00	0.8353	0.7801
28	0.5375E+01	0.2473E+01	0.6703E+03	0.0	0.5521E+03	0.0	-0.6252E+00	-0.1003E+01	0.8327	0.7694
29	0.5626E+01	0.2488E+01	0.6854E+03	0.0	0.5544E+03	0.0	-0.3743E+00	-0.1045E+01	0.8306	0.7599
30	0.5875E+01	0.2497E+01	0.6919E+03	0.0	0.5557E+03	0.0	-0.1245E+00	-0.1063E+01	0.8294	0.7558
31	0.6127E+01	0.2500E+01	0.6866E+03	0.0	0.5561E+03	0.0	-0.1270E+00	-0.1048E+01	0.8290	0.7591
32	0.6407E+01	0.2500E+01	0.6808E+03	0.0	0.5561E+03	0.0	-0.4065E+00	-0.1032E+01	0.8290	0.7628
33	0.6742E+01	0.2500E+01	0.6798E+03	0.0	0.5561E+03	0.0	-0.7419E+00	-0.1025E+01	0.8290	0.7635
34	0.7144E+01	0.2500E+01	0.6806E+03	0.0	0.5561E+03	0.0	-0.1144E+01	-0.1031E+01	0.8290	0.7629
35	0.7627E+01	0.2500E+01	0.6824E+03	0.0	0.5561E+03	0.0	-0.1627E+01	-0.1036E+01	0.8290	0.7618
36	0.8207E+01	0.2500E+01	0.6848E+03	0.0	0.5561E+03	0.0	-0.2207E+01	-0.1043E+01	0.8290	0.7603
37	0.8902E+01	0.2500E+01	0.6874E+03	0.0	0.5561E+03	0.0	-0.2920E+01	-0.1051E+01	0.8290	0.7586
38	0.9737E+01	0.2500E+01	0.6876E+03	0.0	0.5561E+03	0.0	-0.3737E+01	-0.1051E+01	0.8290	0.7585
39	0.1064E+02	0.2500E+01	0.6755E+03	0.0	0.5561E+03	0.0	-0.4644E+01	-0.1071E+01	0.8290	0.7662
40	0.1155E+02	0.2500E+01	0.3738E+03	0.0	0.5561E+03	0.0	-0.5548E+01	-0.3152E+00	0.8290	0.9237

SHROUD  
ON-BODY POINTS

I	X	Y	VP	VTHETA	VRES	VBARI	BETA	S	GPC	RB/RT	PSOPTC
41	0.1155E+02	0.5000E+01	-0.1274E+03	0.0	0.1224E+03	0.5561E+03	0.0	0.5548E+01	-0.1239E+01	0.8290	0.9916
42	0.1064E+02	0.5000E+01	-0.5795E+03	0.0	0.5795E+03	0.5561E+03	0.0	0.4644E+01	-0.7611E+00	0.8290	0.8236
43	0.9737E+01	0.5000E+01	-0.6370E+03	0.0	0.6370E+03	0.5561E+03	0.0	0.3737E+01	-0.9112E+00	0.8290	0.7899
44	0.8902E+01	0.5000E+01	-0.6597E+03	0.0	0.6597E+03	0.5561E+03	0.0	0.2902E+01	-0.9733E+00	0.8290	0.7760
45	0.8207E+01	0.5000E+01	-0.6663E+03	0.0	0.6663E+03	0.5561E+03	0.0	0.2207E+01	-0.9915E+00	0.8290	0.7719
46	0.7627E+01	0.5000E+01	-0.6683E+03	0.0	0.6683E+03	0.5561E+03	0.0	0.1627E+01	-0.9971E+00	0.8290	0.7706
47	0.7144E+01	0.5000E+01	-0.6686E+03	0.0	0.6686E+03	0.5561E+03	0.0	0.1144E+01	-0.9971E+00	0.8290	0.7705
48	0.6742E+01	0.5000E+01	-0.6683E+03	0.0	0.6683E+03	0.5561E+03	0.0	0.7419E+00	-0.9965E+00	0.8290	0.7707
49	0.6407E+01	0.5000E+01	-0.6678E+03	0.0	0.6678E+03	0.5561E+03	0.0	0.4065E+00	-0.9957E+00	0.8290	0.7710
50	0.6127E+01	0.5000E+01	-0.6678E+03	0.0	0.6678E+03	0.5561E+03	0.0	0.1270E+00	-0.9956E+00	0.8290	0.7710
51	0.5875E+01	0.5000E+01	-0.6666E+03	0.0	0.6666E+03	0.5557E+03	0.0	-0.1250E+00	-0.9923E+00	0.8294	0.7717
52	0.5625E+01	0.5000E+01	-0.6662E+03	0.0	0.6662E+03	0.5544E+03	0.0	-0.3750E+00	-0.9913E+00	0.8306	0.7719
53	0.5375E+01	0.5000E+01	-0.6683E+03	0.0	0.6683E+03	0.5521E+03	0.0	-0.6250E+00	-0.9969E+00	0.8327	0.7707
54	0.5125E+01	0.5000E+01	-0.6775E+03	0.0	0.6775E+03	0.5493E+03	0.0	-0.8750E+00	-0.1023E+01	0.8353	0.7649
55	0.4879E+01	0.5005E+01	-0.6931E+03	0.0	0.6931E+03	0.5448E+03	0.0	-0.1121E+01	-0.1067E+01	0.8393	0.7550
56	0.4632E+01	0.5023E+01	-0.6836E+03	0.0	0.6836E+03	0.5362E+03	0.0	-0.1369E+01	-0.1040E+01	0.8466	0.7611
57	0.4373E+01	0.5058E+01	-0.6453E+03	0.0	0.6453E+03	0.5228E+03	0.0	-0.1630E+01	-0.9337E+00	0.8573	0.7849
58	0.4102E+01	0.5109E+01	-0.5953E+03	0.0	0.5953E+03	0.5055E+03	0.0	-0.1906E+01	-0.8014E+00	0.8699	0.8146
59	0.3821E+01	0.5172E+01	-0.5425E+03	0.0	0.5425E+03	0.4859E+03	0.0	-0.2194E+01	-0.6697E+00	0.8827	0.8441
60	0.3531E+01	0.5234E+01	-0.4923E+03	0.0	0.4923E+03	0.4655E+03	0.0	-0.2493E+01	-0.6531E+00	0.8949	0.8703
61	0.3236E+01	0.5315E+01	-0.4483E+03	0.0	0.4483E+03	0.4460E+03	0.0	-0.2795E+01	-0.4585E+00	0.9054	0.8915
62	0.2945E+01	0.5381E+01	-0.4127E+03	0.0	0.4127E+03	0.4291E+03	0.0	-0.3094E+01	-0.3872E+00	0.9138	0.9075

63	0.2662E+01	0.5436E+01	-0.3867E+03	0.3867E+03	0.4155E+03	0.3383E+01	-0.3384E+00	0.9201	0.9185
64	0.2390E+01	0.5475E+01	-0.3713E+03	0.3713E+03	0.4056E+03	0.3658E+01	-0.3659E+00	0.9245	0.9246
65	0.2128E+01	0.5495E+01	-0.3705E+03	0.3705E+03	0.3994E+03	0.3920E+01	-0.394E+00	0.9272	0.9250
66	0.1887E+01	0.5500E+01	-0.3857E+03	0.3857E+03	0.3957E+03	0.4161E+01	-0.3366E+00	0.9286	0.9189
67	0.1673E+01	0.5504E+01	-0.4063E+03	0.4063E+03	0.3930E+03	0.4375E+01	-0.3750E+00	0.9298	0.9102
68	0.1476E+01	0.5513E+01	-0.4198E+03	0.4198E+03	0.3890E+03	0.4572E+01	-0.4011E+00	0.9314	0.9044
69	0.1287E+01	0.5531E+01	-0.4279E+03	0.4279E+03	0.3834E+03	0.4742E+01	-0.4171E+00	0.9337	0.9008
70	0.1107E+01	0.5560E+01	-0.4295E+03	0.4295E+03	0.3760E+03	0.4945E+01	-0.4203E+00	0.9365	0.9001
71	0.9352E+00	0.5602E+01	-0.4239E+03	0.4239E+03	0.3667E+03	0.5122E+01	-0.4090E+00	0.9400	0.9026
72	0.7730E+00	0.5657E+01	-0.4108E+03	0.4108E+03	0.3557E+03	0.5293E+01	-0.3836E+00	0.9440	0.9083
73	0.6209E+00	0.5727E+01	-0.3901E+03	0.3901E+03	0.3432E+03	0.5460E+01	-0.3447E+00	0.9482	0.9170
74	0.4811E+00	0.5811E+01	-0.3630E+03	0.3630E+03	0.3294E+03	0.5624E+01	-0.2965E+00	0.9527	0.9279
75	0.3557E+00	0.5910E+01	-0.3302E+03	0.3302E+03	0.3150E+03	0.5783E+01	-0.2423E+00	0.9571	0.9400
76	0.2457E+00	0.6022E+01	-0.2930E+03	0.2930E+03	0.3001E+03	0.5949E+01	-0.1864E+00	0.9613	0.9526
77	0.1537E+00	0.6147E+01	-0.2528E+03	0.2528E+03	0.2851E+03	0.6096E+01	-0.1331E+00	0.9654	0.9645
78	0.8191E-01	0.6283E+01	-0.2112E+03	0.2112E+03	0.2704E+03	0.6249E+01	-0.8565E-01	0.9690	0.9752
79	0.3236E-01	0.6427E+01	-0.1689E+03	0.1689E+03	0.2563E+03	0.6401E+01	-0.4607E-01	0.9723	0.9841
80	0.6693E-02	0.6575E+01	-0.1235E+03	0.1235E+03	0.2431E+03	0.6552E+01	-0.1308E-01	0.9752	0.9915
81	0.	0.6741E+01	-0.8477E+02	0.8477E+02	0.2295E+03	0.6718E+01	0.7025E-02	0.9780	0.9960
82	0.	0.6942E+01	-0.6184E+02	0.6184E+02	0.2130E+03	0.6919E+01	0.1543E-01	0.9812	0.9979
83	0.	0.7183E+01	-0.4170E+02	0.4170E+02	0.1953E+03	0.7160E+01	0.2065E-01	0.9843	0.9990
84	0.	0.7472E+01	-0.2395E+02	0.2395E+02	0.1766E+03	0.7449E+01	0.2356E-01	0.9872	0.9997
85	0.	0.7819E+01	-0.8000E+01	0.8000E+01	0.1573E+03	0.7796E+01	0.2484E-01	0.9899	1.0000
86	0.	0.8236E+01	0.6482E+01	0.6482E+01	0.1376E+03	0.8213E+01	0.2489E-01	0.9923	1.0000
87	0.	0.8736E+01	0.1968E+02	0.1968E+02	0.1182E+03	0.8712E+01	0.2403E-01	0.9943	0.9998
88	0.	0.9335E+01	0.3168E+02	0.3168E+02	0.9946E+02	0.9312E+01	0.2245E-01	0.9960	0.9994
89	0.	0.1006E+02	0.4252E+02	0.4252E+02	0.8190E+02	0.1003E+02	0.2047E-01	0.9973	0.9990
90	0.	0.1092E+02	0.5217E+02	0.5217E+02	0.6592E+02	0.1090E+02	0.1819E-01	0.9983	0.9985
91	0.	0.1187E+02	0.6113E+02	0.6113E+02	0.5283E+02	0.1184E+02	0.1565E-01	0.9989	0.9979
92	0.	0.1282E+02	0.6819E+02	0.6819E+02	0.4295E+02	0.1280E+02	0.1336E-01	0.9993	0.9974
93	0.	0.1378E+02	0.7394E+02	0.7394E+02	0.3540E+02	0.1376E+02	0.1132E-01	0.9995	0.9969
94	0.	0.1474E+02	0.7882E+02	0.7882E+02	0.2953E+02	0.1471E+02	0.9456E-02	0.9996	0.9965
95	0.	0.1569E+02	0.8318E+02	0.8318E+02	0.2489E+02	0.1567E+02	0.7691E-02	0.9998	0.9961
96	0.	0.1665E+02	0.8734E+02	0.8734E+02	0.2118E+02	0.1663E+02	0.5926E-02	0.9998	0.9957
97	0.	0.1761E+02	0.9172E+02	0.9172E+02	0.1818E+02	0.1758E+02	0.3961E-02	0.9999	0.9953
98	0.	0.1856E+02	0.9723E+02	0.9723E+02	0.1571E+02	0.1854E+02	0.1365E-02	0.9999	0.9947
99	0.	0.1952E+02	0.1113E+03	0.1113E+03	0.1368E+02	0.1950E+02	-0.5941E-02	0.9960	0.9931

## OFF-BODY POINTS (RAKES)

I	COORDINATES			VELOCITIES										PRESS. RATIO	
	AXIAL	RADIAL	Y	AXIAL	VX	RADIAL	VY	CIRCUMFNTL	RESULTANT	MERIDIONAL	CHORDWISE	SPANWISE	VSPAN	RHOBR	PSOPTC
1														COMP	
	AXIAL	RADIAL	Y	AXIAL	VX	RADIAL	VY	VZ	VRES	VM	VAFT	SPANWISE	VSPAN	RHOBR	PSOPTC
1	2.0000E+00	1.9996E+00	4.1188E+02	7.0619E+01	-0.	4.1789E+02	4.1789E+02	4.1789E+02	4.1789E+02	4.1789E+02	7.0619E+01	0.	0.	0.9280	0.9052
2	2.0000E+00	2.5000E+00	4.0442E+02	5.3993E+01	0.	4.0801E+02	4.0801E+02	4.0801E+02	4.0801E+02	4.0801E+02	5.3993E+01	0.	0.	0.9280	0.9052
3	2.0000E+00	3.5000E+00	3.9746E+02	8.5291E+00	0.	4.0148E+02	4.0148E+02	4.0148E+02	4.0148E+02	4.0148E+02	3.1052E+01	0.	0.	0.9280	0.9139
4	2.0000E+00	4.0000E+00	3.9510E+02	-1.1332E+01	0.	3.9755E+02	3.9755E+02	3.9755E+02	3.9755E+02	3.9755E+02	8.5291E+00	0.	0.	0.9280	0.9149
5	2.0000E+00	4.5000E+00	3.9261E+02	-2.6037E+01	0.	3.9526E+02	3.9526E+02	3.9526E+02	3.9526E+02	3.9526E+02	-1.1332E+01	0.	0.	0.9280	0.9156
6	2.0000E+00	5.0000E+00	3.8855E+02	-2.9855E+01	0.	3.9348E+02	3.9348E+02	3.9348E+02	3.9348E+02	3.9348E+02	-2.6037E+01	0.	0.	0.9280	0.9172
7	2.0000E+00	5.4981E+00	3.7736E+02	-7.7115E+00	0.	3.8970E+02	3.8970E+02	3.8970E+02	3.8970E+02	3.8970E+02	-2.9855E+01	0.	0.	0.9280	0.9222
8	2.0000E+00	5.5091E+02	7.6792E+01	-0.	0.	3.7746E+02	3.7746E+02	3.7746E+02	3.7746E+02	3.7746E+02	-8.7115E+00	0.	0.	0.8746	0.8366
9	2.0000E+00	5.4905E+02	4.6162E+01	0.	0.	5.5099E+02	5.5099E+02	5.5099E+02	5.5099E+02	5.5099E+02	4.6162E+01	0.	0.	0.8746	0.8395
10	2.0000E+00	3.5000E+00	5.4851E+02	3.0473E+01	0.	5.4935E+02	5.4935E+02	5.4935E+02	5.4935E+02	5.4935E+02	3.0473E+01	0.	0.	0.8746	0.8404
11	2.0000E+00	3.5000E+00	5.4850E+02	1.5926E+01	0.	5.4873E+02	5.4873E+02	5.4873E+02	5.4873E+02	5.4873E+02	1.5926E+01	0.	0.	0.8746	0.8407
12	2.0000E+00	3.5000E+00	5.4908E+02	1.9939E+00	0.	5.4908E+02	5.4908E+02	5.4908E+02	5.4908E+02	5.4908E+02	1.9939E+00	0.	0.	0.8746	0.8405
13	2.0000E+00	3.5000E+00	5.5034E+02	-1.1847E+01	0.	5.5047E+02	5.5047E+02	5.5047E+02	5.5047E+02	5.5047E+02	-1.1847E+01	0.	0.	0.8746	0.8398
14	2.0000E+00	4.0000E+00	5.5239E+02	-2.6186E+01	0.	5.5301E+02	5.5301E+02	5.5301E+02	5.5301E+02	5.5301E+02	-2.6186E+01	0.	0.	0.8746	0.8363
15	2.0000E+00	4.2500E+00	5.5530E+02	-4.1762E+01	0.	5.5687E+02	5.5687E+02	5.5687E+02	5.5687E+02	5.5687E+02	-4.1762E+01	0.	0.	0.8746	0.8333
16	2.0000E+00	4.7500E+00	5.5904E+02	-8.1123E+01	0.	5.6220E+02	5.6220E+02	5.6220E+02	5.6220E+02	5.6220E+02	-8.1123E+01	0.	0.	0.8746	0.8295
17	2.0000E+00	5.1310E+00	5.6211E+02	-1.2421E+02	0.	5.7567E+02	5.7567E+02	5.7567E+02	5.7567E+02	5.7567E+02	-1.2421E+02	0.	0.	0.8746	0.8258
18	2.0000E+00	2.4990E+00	6.8925E+02	7.2363E+00	0.	6.8929E+02	6.8929E+02	6.8929E+02	6.8929E+02	6.8929E+02	7.2363E+00	0.	0.	0.8291	0.7574
19	2.0000E+00	2.7500E+00	6.8081E+02	1.1238E+01	0.	6.8090E+02	6.8090E+02	6.8090E+02	6.8090E+02	6.8090E+02	1.1238E+01	0.	0.	0.8291	0.7673
20	2.0000E+00	3.0000E+00	6.7363E+02	1.1131E+01	0.	6.7372E+02	6.7372E+02	6.7372E+02	6.7372E+02	6.7372E+02	1.1131E+01	0.	0.	0.8291	0.7699
21	2.0000E+00	3.2500E+00	6.6952E+02	9.3051E+00	0.	6.6959E+02	6.6959E+02	6.6959E+02	6.6959E+02	6.6959E+02	9.3051E+00	0.	0.	0.8291	0.7712
22	2.0000E+00	3.5000E+00	6.6746E+02	6.9361E+00	0.	6.6749E+02	6.6749E+02	6.6749E+02	6.6749E+02	6.6749E+02	6.9361E+00	0.	0.	0.8291	0.7712
23	2.0000E+00	3.7500E+00	6.6688E+02	4.5743E+00	0.	6.6690E+02	6.6690E+02	6.6690E+02	6.6690E+02	6.6690E+02	4.5743E+00	0.	0.	0.8291	0.7712
24	2.0000E+00	4.0000E+00	6.6740E+02	2.5486E+00	0.	6.6741E+02	6.6741E+02	6.6741E+02	6.6741E+02	6.6741E+02	2.5486E+00	0.	0.	0.8291	0.7704
25	2.0000E+00	4.2500E+00	6.6864E+02	1.0789E+00	0.	6.6864E+02	6.6864E+02	6.6864E+02	6.6864E+02	6.6864E+02	1.0789E+00	0.	0.	0.8291	0.7695
26	2.0000E+00	4.5000E+00	6.7015E+02	2.7859E+01	0.	6.7016E+02	6.7016E+02	6.7016E+02	6.7016E+02	6.7016E+02	2.7859E+01	0.	0.	0.8291	0.7687
27	2.0000E+00	4.7500E+00	6.7149E+02	7.3076E+02	0.	6.7149E+02	6.7149E+02	6.7149E+02	6.7149E+02	6.7149E+02	7.3076E+02	0.	0.	0.8291	0.7714
28	2.0000E+00	5.0000E+00	6.6708E+02	0.	-0.	6.6708E+02	6.6708E+02	6.6708E+02	6.6708E+02	6.6708E+02	-0.	0.	0.	0.8291	0.7714

I	COORDINATES			ANGLES										QFRACT	
	AXIAL	RADIAL	Y	NEW	CP	MERIDIONAL	FLOW	UNDERTURNING	SPANWISE	SWIRL	PHI	QFRACT	PHI	COMP	
1														COMP	
	AXIAL	RADIAL	Y	NEW	CP	MERIDIONAL	FLOW	UNDERTURNING	SPANWISE	SWIRL	PHI	QFRACT	PHI	COMP	
1	2.0000E+00	1.9996E+00	4.1188E+02	7.0619E+01	-0.	9.7290E+00	0.	9.7290E+00	0.	0.	0.	0.	0.	0.8332E-02	0.
2	2.0000E+00	2.5000E+00	4.0442E+02	5.3993E+01	0.	7.6044E+00	0.	7.6044E+00	0.	0.	0.	0.	0.	1.9502E-01	0.
3	2.0000E+00	3.5000E+00	3.9746E+02	8.5291E+00	0.	4.4359E+00	0.	4.4359E+00	0.	0.	0.	0.	0.	3.2025E-01	0.
4	2.0000E+00	4.0000E+00	3.9510E+02	-1.1332E+01	0.	1.2293E+00	0.	1.2293E+00	0.	0.	0.	0.	0.	4.6396E-01	0.
5	2.0000E+00	4.5000E+00	3.9261E+02	-2.6037E+01	0.	-1.6429E+00	0.	-1.6429E+00	0.	0.	0.	0.	0.	6.2595E-01	0.
6	2.0000E+00	5.0000E+00	3.8855E+02	-2.9855E+01	0.	-3.7941E+00	0.	-3.7941E+00	0.	0.	0.	0.	0.	8.0563E-01	0.
7	2.0000E+00	5.4981E+00	3.7736E+02	-7.7115E+00	0.	-4.3937E+00	0.	-4.3937E+00	0.	0.	0.	0.	0.	1.0000E+00	0.
8	2.0000E+00	5.5091E+02	7.6792E+01	-0.	0.	7.9354E+00	0.	7.9354E+00	0.	0.	0.	0.	0.	1.229E-01	0.
9	2.0000E+00	5.4905E+02	4.6162E+01	0.	0.	4.8058E+00	0.	4.8058E+00	0.	0.	0.	0.	0.	1.7055E-01	0.
10	2.0000E+00	3.5000E+00	5.4851E+02	3.0473E+01	0.	3.1798E+00	0.	3.1798E+00	0.	0.	0.	0.	0.	2.4475E-01	0.
11	2.0000E+00	3.5000E+00	5.4850E+02	1.5926E+01	0.	1.6631E+00	0.	1.6631E+00	0.	0.	0.	0.	0.	3.2493E-01	0.
12	2.0000E+00	3.5000E+00	5.4908E+02	1.9939E+00	0.	2.0806E-01	0.	2.0806E-01	0.	0.	0.	0.	0.	4.1116E-01	0.
13	2.0000E+00	3.5000E+00	5.5034E+02	-1.1847E+01	0.	-1.2332E+00	0.	-1.2332E+00	0.	0.	0.	0.	0.	5.0353E-01	0.
14	2.0000E+00	4.0000E+00	5.5239E+02	-2.6186E+01	0.	-2.7140E+00	0.	-2.7140E+00	0.	0.	0.	0.	0.	6.0216E-01	0.
15	2.0000E+00	4.2500E+00	5.5530E+02	-4.1762E+01	0.	-6.0093E+00	0.	-6.0093E+00	0.	0.	0.	0.	0.	7.0716E-01	0.
16	2.0000E+00	4.7500E+00	5.5904E+02	-8.1123E+01	0.	-6.0853E+00	0.	-6.0853E+00	0.	0.	0.	0.	0.	8.1863E-01	0.
17	2.0000E+00	5.1310E+00	5.6211E+02	-1.2421E+02	0.	-8.1962E+00	0.	-8.1962E+00	0.	0.	0.	0.	0.	1.0000E+00	0.
18	2.0000E+00	2.4990E+00	6.8925E+02	7.2363E+00	0.	-1.2461E+01	0.	-1.2461E+01	0.	0.	0.	0.	0.	1.0000E+00	0.
19	2.0000E+00	2.7500E+00	6.8081E+02	1.1238E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
20	2.0000E+00	3.0000E+00	6.7363E+02	1.1131E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
21	2.0000E+00	3.2500E+00	6.6952E+02	9.3051E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
22	2.0000E+00	3.5000E+00	6.6746E+02	6.9361E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
23	2.0000E+00	3.7500E+00	6.6688E+02	4.5743E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
24	2.0000E+00	4.0000E+00	6.6740E+02	2.5486E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
25	2.0000E+00	4.2500E+00	6.6864E+02	1.0789E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
26	2.0000E+00	4.5000E+00	6.7015E+02	2.7859E+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
27	2.0000E+00	4.7500E+00	6.7149E+02	7.3076E+02	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
28	2.0000E+00	5.0000E+00	6.6708E+02	0.	-0.	0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.

16	6.0000E+00	2.4990E+00	-1.0559E+00	6.0152E-01	-0.	6.0152E-01	0.	-0.	0.
17	6.0000E+00	2.7500E+00	-1.0322E+00	9.4572E-01	0.	9.4572E-01	0.	0.	7.1136E-02
18	6.0000E+00	3.0000E+00	-1.0121E+00	9.4670E-01	0.	9.4670E-01	0.	0.	1.4822E-01
19	6.0000E+00	3.2500E+00	-1.0006E+00	7.9625E-01	0.	7.9625E-01	0.	0.	2.3159E-01
20	6.0000E+00	3.5000E+00	-9.9478E-01	5.9538E-01	0.	5.9538E-01	0.	0.	3.2138E-01
21	6.0000E+00	3.7500E+00	-9.9313E-01	3.9299E-01	0.	3.9299E-01	0.	0.	4.1771E-01
22	6.0000E+00	4.0000E+00	-9.9454E-01	2.1878E-01	0.	2.1878E-01	0.	0.	5.2068E-01
23	6.0000E+00	4.2500E+00	-9.9595E-01	9.2455E-02	0.	9.2455E-02	0.	0.	6.3039E-01
24	6.0000E+00	4.5000E+00	-1.0022E+00	2.3819E-02	0.	2.3819E-02	0.	0.	7.4689E-01
25	6.0000E+00	4.7500E+00	-1.0059E+00	6.2353E-03	0.	6.2353E-03	0.	0.	8.7021E-01
26	6.0000E+00	5.0000E+00	-9.9362E-01	0.	-0.	-0.	0.	-0.	1.3000E+00

# RELATIVE ROTOR INLET DATA

X = 6.0000 UTIP = 900.0000

Y	U	VZPRIME	VPRIM	MPRIME	BETAPR	VZPRST	VPRST	MPRS	BETAPS
2.4990E+00	4.4982E+02	-4.4982E+02	8.2307E+02	7.6742E-01	-3.3128E+01	-4.4982E+02	8.2307E+02	7.6742E-01	-3.3128E+01
2.7500E+00	4.9500E+02	-4.9500E+02	8.4181E+02	7.8411E-01	-3.6016E+01	-4.9500E+02	8.4181E+02	7.8411E-01	-3.6016E+01
3.0000E+00	5.4000E+02	-5.4000E+02	8.6342E+02	8.0356E-01	-3.8713E+01	-5.4000E+02	8.6342E+02	8.0356E-01	-3.8713E+01
3.2500E+00	5.8500E+02	-5.8500E+02	8.8914E+02	8.2710E-01	-4.1143E+01	-5.8500E+02	8.8914E+02	8.2710E-01	-4.1143E+01
3.5000E+00	6.3000E+02	-6.3000E+02	9.1785E+02	8.5359E-01	-4.3345E+01	-6.3000E+02	9.1785E+02	8.5359E-01	-4.3345E+01
3.7500E+00	6.7500E+02	-6.7500E+02	9.4888E+02	8.8240E-01	-4.5346E+01	-6.7500E+02	9.4888E+02	8.8240E-01	-4.5346E+01
4.0000E+00	7.2000E+02	-7.2000E+02	9.8175E+02	9.1301E-01	-4.7171E+01	-7.2000E+02	9.8175E+02	9.1301E-01	-4.7171E+01
4.2500E+00	7.6500E+02	-7.6500E+02	1.0160E+03	9.4502E-01	-4.8845E+01	-7.6500E+02	1.0160E+03	9.4502E-01	-4.8845E+01
4.5000E+00	8.1000E+02	-8.1000E+02	1.0513E+03	9.7799E-01	-5.0397E+01	-8.1000E+02	1.0513E+03	9.7799E-01	-5.0397E+01
4.7500E+00	8.5500E+02	-8.5500E+02	1.0872E+03	1.0115E+00	-5.1855E+01	-8.5500E+02	1.0872E+03	1.0115E+00	-5.1855E+01
5.0000E+00	9.0000E+02	-9.0000E+02	1.1203E+03	1.0418E+00	-5.3454E+01	-9.0000E+02	1.1203E+03	1.0418E+00	-5.3454E+01

# RAKE WEIGHT FLOW DATA

I	X	(Q(I)-QBARI)/QBAR	QS TOT	QFR
1	2.0000E+00	-6.9979E-02	1.6190E+01	1.0000E+00
2	4.0000E+00	-2.1595E-02	1.7032E+01	1.0000E+00
3	6.0000E+00	0.	1.7408E+01	1.0000E+00

# STREAMLINES

X =	2.000	YSTRM
2.0000E-02	2.11972E+00	
4.0000E-02	2.23588E+00	
6.0000E-02	2.34802E+00	
8.0000E-02	2.45614E+00	
1.0000E-01	2.55800E+00	
1.2000E-01	2.65522E+00	
1.4000E-01	2.75065E+00	
1.6000E-01	2.84339E+00	
1.8000E-01	2.93373E+00	
2.0000E-01	3.02103E+00	
2.2000E-01	3.10452E+00	
2.4000E-01	3.18448E+00	
2.6000E-01	3.26692E+00	
2.8000E-01	3.34583E+00	
3.0000E-01	3.42321E+00	
3.2000E-01	3.49906E+00	
3.4000E-01	3.57186E+00	
3.6000E-01	3.64361E+00	

3.80000E-01 3.71432E+00  
 4.00000E-01 3.78402E+00  
 4.20000E-01 3.85268E+00  
 4.40000E-01 3.92032E+00  
 4.60000E-01 3.98693E+00  
 4.80000E-01 4.05159E+00  
 5.00000E-01 4.11528E+00  
 5.20000E-01 4.17826E+00  
 5.40000E-01 4.24052E+00  
 5.60000E-01 4.30208E+00  
 5.80000E-01 4.36292E+00  
 6.00000E-01 4.42305E+00  
 6.20000E-01 4.48247E+00  
 6.40000E-01 4.54047E+00  
 6.60000E-01 4.59767E+00  
 6.80000E-01 4.65440E+00  
 7.00000E-01 4.71066E+00  
 7.20000E-01 4.76645E+00  
 7.40000E-01 4.82177E+00  
 7.60000E-01 4.87662E+00  
 7.80000E-01 4.93099E+00  
 8.00000E-01 4.98490E+00  
 8.20000E-01 5.03834E+00  
 8.40000E-01 5.09130E+00  
 8.60000E-01 5.14380E+00  
 8.80000E-01 5.19583E+00  
 9.00000E-01 5.24738E+00  
 9.20000E-01 5.29846E+00  
 9.40000E-01 5.34908E+00  
 9.60000E-01 5.39922E+00  
 9.80000E-01 5.44890E+00  
 1.00000E+00 5.49810E+00

X = 4.000

QSTRM	YSTRM
2.00000E-02	2.41343E+00
4.00000E-02	2.49876E+00
6.00000E-02	2.58183E+00
8.00000E-02	2.66262E+00
1.00000E-01	2.74114E+00
1.20000E-01	2.81669E+00
1.40000E-01	2.89047E+00
1.60000E-01	2.96260E+00
1.80000E-01	3.03283E+00
2.00000E-01	3.10137E+00
2.20000E-01	3.16860E+00
2.40000E-01	3.23453E+00
2.60000E-01	3.29885E+00
2.80000E-01	3.36199E+00
3.00000E-01	3.42408E+00
3.20000E-01	3.48512E+00
3.40000E-01	3.54485E+00
3.60000E-01	3.60361E+00
3.80000E-01	3.66151E+00
4.00000E-01	3.71855E+00
4.20000E-01	3.77459E+00
4.40000E-01	3.82970E+00
4.60000E-01	3.88409E+00
4.80000E-01	3.93777E+00
5.00000E-01	3.99072E+00

5.20000E-01	4.04277E+00
5.40000E-01	4.09415E+00
5.60000E-01	4.14494E+00
5.80000E-01	4.19511E+00
6.00000E-01	4.24468E+00
6.20000E-01	4.29347E+00
6.40000E-01	4.34172E+00
6.60000E-01	4.38945E+00
6.80000E-01	4.43668E+00
7.00000E-01	4.48339E+00
7.20000E-01	4.52940E+00
7.40000E-01	4.57490E+00
7.60000E-01	4.62000E+00
7.80000E-01	4.66472E+00
8.00000E-01	4.70905E+00
8.20000E-01	4.75299E+00
8.40000E-01	4.79655E+00
8.60000E-01	4.83971E+00
8.80000E-01	4.88249E+00
9.00000E-01	4.92489E+00
9.20000E-01	4.96689E+00
9.40000E-01	5.00851E+00
9.60000E-01	5.04974E+00
9.80000E-01	5.09058E+00
1.00000E+00	5.13104E+00

X = 6.000

QSTRM	YSTRM
2.00000E-02	2.57153E+00
4.00000E-02	2.64253E+00
6.00000E-02	2.71199E+00
8.00000E-02	2.77967E+00
1.00000E-01	2.84573E+00
1.20000E-01	2.91058E+00
1.40000E-01	2.97421E+00
1.60000E-01	3.03637E+00
1.80000E-01	3.09733E+00
2.00000E-01	3.15730E+00
2.20000E-01	3.21628E+00
2.40000E-01	3.27412E+00
2.60000E-01	3.33088E+00
2.80000E-01	3.38682E+00
3.00000E-01	3.44196E+00
3.20000E-01	3.49628E+00
3.40000E-01	3.54954E+00
3.60000E-01	3.60210E+00
3.80000E-01	3.65399E+00
4.00000E-01	3.70521E+00
4.20000E-01	3.75573E+00
4.40000E-01	3.80538E+00
4.60000E-01	3.85448E+00
4.80000E-01	3.90301E+00
5.00000E-01	3.95098E+00
5.20000E-01	3.99840E+00
5.40000E-01	4.04505E+00
5.60000E-01	4.09123E+00
5.80000E-01	4.13694E+00
6.00000E-01	4.18217E+00
6.20000E-01	4.22694E+00
6.40000E-01	4.27114E+00



6.60000E-01 4.31482E+00  
6.80000E-01 4.35811E+00  
7.00000E-01 4.40100E+00  
7.20000E-01 4.44349E+00  
7.40000E-01 4.48559E+00  
7.60000E-01 4.52716E+00  
7.80000E-01 4.56832E+00  
8.00000E-01 4.60916E+00  
8.20000E-01 4.64968E+00  
8.40000E-01 4.68989E+00  
8.60000E-01 4.72977E+00  
8.80000E-01 4.76933E+00  
9.00000E-01 4.80858E+00  
9.20000E-01 4.84750E+00  
9.40000E-01 4.88610E+00  
9.60000E-01 4.92439E+00  
9.80000E-01 4.96235E+00  
1.00000E+00 5.00000E+00

2 OF 3 THETAS

THEIA = 0.90000E+02 WDOIT = 1.78504E+01 VICT = 5.70305E+02 V3 = -1.42602E-01

HUB  
ON-BODY POINTS

I	X	Y	VP	VTHEIA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC
1	0.	0.1250E+00	0.1173E+02	0.8840E+02	0.8918E+02	0.2354E+03	0.8244E+02	-0.7153E+01	0.511CE-02	0.9769	0.9955
2	-0.	0.3750E+00	0.3513E+02	0.8910E+02	0.9578E+02	0.2354E+03	0.6848E+02	-0.6903E+01	0.2063E-02	0.9769	0.9949
3	0.8379E-02	0.6254E+00	0.7448E+02	0.9143E+02	0.1179E+03	0.2503E+03	0.5093E+02	-0.6652E+01	0.9741E-02	0.9737	0.9922
4	0.4613E-01	0.8560E+00	0.1401E+03	0.9484E+02	0.1692E+03	0.2671E+03	0.3410E+02	-0.6418E+01	-0.463CE-01	0.9698	0.9840
5	0.1267E+00	0.1057E+01	0.1989E+03	0.9712E+02	0.2214E+03	0.2869E+03	0.2602E+02	-0.6202E+01	-0.9654E-01	0.9649	0.9727
6	0.2493E+00	0.1236E+01	0.2492E+03	0.9810E+02	0.2678E+03	0.3080E+03	0.2148E+02	-0.5986E+01	-0.1521E+00	0.9591	0.9603
7	0.3999E+00	0.1392E+01	0.2903E+03	0.9795E+02	0.3064E+03	0.3285E+03	0.1864E+02	-0.5768E+01	-0.2057E+03	0.9530	0.9482
8	0.5738E+00	0.1524E+01	0.3239E+03	0.9694E+02	0.3381E+03	0.3474E+03	0.1666E+02	-0.5549E+01	-0.2545E+00	0.9468	0.9372
9	0.7639E+00	0.1636E+01	0.3520E+03	0.9531E+02	0.3644E+03	0.3641E+03	0.1515E+02	-0.5329E+01	-0.2993E+03	0.9410	0.9272
10	0.9693E+00	0.1731E+01	0.3764E+03	0.9315E+02	0.3877E+03	0.3781E+03	0.1390E+02	-0.5103E+01	-0.3403E+03	0.9357	0.9180
11	0.1186E+01	0.1811E+01	0.3970E+03	0.9057E+02	0.4072E+03	0.3892E+03	0.1285E+02	-0.4871E+01	-0.3768E+03	0.9314	0.9098
12	0.1412E+01	0.1878E+01	0.4136E+03	0.8766E+02	0.4228E+03	0.3972E+03	0.1197E+02	-0.4636E+01	-0.407CE+03	0.9281	0.9031
13	0.1643E+01	0.1933E+01	0.4257E+03	0.8450E+02	0.4340E+03	0.4025E+03	0.1123E+02	-0.4398E+01	-0.4293E+03	0.9258	0.8981
14	0.1890E+01	0.1979E+01	0.4333E+03	0.8117E+02	0.4408E+03	0.4060E+03	0.1061E+02	-0.4157E+01	-0.4431E+03	0.9243	0.8950
15	0.2125E+01	0.2021E+01	0.4401E+03	0.7769E+02	0.4469E+03	0.4095E+03	0.1001E+02	-0.3908E+01	-0.4556E+03	0.9228	0.8921
16	0.2375E+01	0.2063E+01	0.4510E+03	0.7416E+02	0.4570E+03	0.4155E+03	0.9338E+01	-0.3655E+01	-0.4767E+03	0.9201	0.8874
17	0.2625E+01	0.2104E+01	0.4654E+03	0.7068E+02	0.4707E+03	0.4245E+03	0.8636E+01	-0.3402E+01	-0.5057E+03	0.9160	0.8809
18	0.2875E+01	0.2146E+01	0.4820E+03	0.6729E+02	0.4867E+03	0.4363E+03	0.7946E+01	-0.3148E+01	-0.5407E+03	0.9103	0.8731
19	0.3125E+01	0.2188E+01	0.5010E+03	0.6401E+02	0.5051E+03	0.4505E+03	0.7281E+01	-0.2895E+01	-0.5820E+03	0.9031	0.8638
20	0.3375E+01	0.2229E+01	0.5232E+03	0.6089E+02	0.5267E+03	0.4667E+03	0.6638E+01	-0.2641E+01	-0.6322E+03	0.8942	0.8525
21	0.3625E+01	0.2270E+01	0.5485E+03	0.5795E+02	0.5515E+03	0.4842E+03	0.6031E+01	-0.2388E+01	-0.6916E+03	0.8838	0.8392
22	0.3874E+01	0.2308E+01	0.5738E+03	0.5519E+02	0.5764E+03	0.5023E+03	0.5494E+01	-0.2136E+01	-0.7533E+03	0.8721	0.8254
23	0.4123E+01	0.2343E+01	0.5979E+03	0.5260E+02	0.6002E+03	0.5199E+03	0.5028E+01	-0.1884E+01	-0.8135E+03	0.8595	0.8118
24	0.4373E+01	0.2375E+01	0.6217E+03	0.5016E+02	0.6237E+03	0.5361E+03	0.4613E+01	-0.1632E+01	-0.8758E+03	0.8467	0.7979
25	0.4623E+01	0.2404E+01	0.6450E+03	0.4783E+02	0.6476E+03	0.5498E+03	0.4241E+01	-0.1380E+01	-0.9377E+03	0.8351	0.7740
26	0.4874E+01	0.2430E+01	0.6664E+03	0.4553E+02	0.6679E+03	0.5585E+03	0.3908E+01	-0.1129E+01	-0.996CE+03	0.8266	0.7409
27	0.5125E+01	0.2453E+01	0.6852E+03	0.4325E+02	0.6865E+03	0.5633E+03	0.3612E+01	-0.8767E+00	-0.1048E+01	0.8219	0.7592
28	0.5375E+01	0.2473E+01	0.7020E+03	0.4108E+02	0.7032E+03	0.5662E+03	0.3349E+01	-0.6252E+00	-0.1095E+01	0.8190	0.7486
29	0.5626E+01	0.2488E+01	0.7165E+03	0.3907E+02	0.7175E+03	0.5685E+03	0.3121E+01	-0.3743E+00	-0.1137E+01	0.8166	0.7393
30	0.5875E+01	0.2497E+01	0.7219E+03	0.3718E+02	0.7228E+03	0.5699E+03	0.2948E+01	-0.1245E+00	-0.1152E+01	0.8151	0.7358
31	0.6127E+01	0.2500E+01	0.7146E+03	0.3539E+02	0.7155E+03	0.5703E+03	0.2835E+01	0.1270E+00	-0.1131E+01	0.8147	0.7406
32	0.6407E+01	0.2500E+01	0.7063E+03	0.3364E+02	0.7071E+03	0.5703E+03	0.2727E+01	0.4065E+00	-0.1107E+01	0.8147	0.7461

I	X	Y	VP	VTNETA	VRES	VBARI	BETA	S	CFC	RB/RT	PSOPTIC
33	0.6742E+01	0.2500E+01	0.7028E+03	0.3185E+02	0.7035E+03	0.5703E+03	0.2595E+01	0.7419E+00	-0.1094E+01	0.8147	0.7483
34	0.7144E+01	0.2500E+01	0.7010E+03	0.3006E+02	0.7016E+03	0.5703E+03	0.2456E+01	0.1144E+01	-0.1391E+01	0.8147	0.7496
35	0.7627E+01	0.2500E+01	0.6998E+03	0.2839E+02	0.7004E+03	0.5703E+03	0.2323E+01	0.1627E+01	-0.1087E+01	0.8147	0.7504
36	0.8207E+01	0.2500E+01	0.6989E+03	0.2700E+02	0.6994E+03	0.5703E+03	0.2212E+01	0.2207E+01	-0.1085E+01	0.8147	0.7510
37	0.8902E+01	0.2500E+01	0.6979E+03	0.2616E+02	0.6984E+03	0.5703E+03	0.2147E+01	0.2902E+01	-0.1082E+01	0.8147	0.7516
38	0.9737E+01	0.2500E+01	0.6946E+03	0.2618E+02	0.6951E+03	0.5703E+03	0.2159E+01	0.3674E+01	-0.1072E+01	0.8147	0.7537
39	0.1054E+02	0.2500E+01	0.6801E+03	0.2705E+02	0.6806E+03	0.5703E+03	0.2278E+01	0.4744E+01	-0.1031E+01	0.8147	0.7629
40	0.1155E+02	0.2500E+01	0.3710E+03	0.2605E+02	0.3719E+03	0.5703E+03	0.4017E+01	0.5548E+01	-0.3119E+00	0.8147	0.9244
41	0.1155E+02	0.5000E+01	-0.6888E+02	0.1700E+02	0.7095E+02	0.5703E+03	-0.1386E+02	0.5548E+01	0.1240E-01	0.8147	0.9972
42	0.1054E+02	0.5000E+01	-0.5681E+03	0.1522E+02	0.5683E+03	0.5703E+03	-0.1535E+01	0.4644E+01	-0.7329E+00	0.8147	0.8299
43	0.9737E+01	0.5000E+01	-0.6380E+03	0.1401E+02	0.6382E+03	0.5703E+03	-0.1258E+01	0.3737E+01	-0.9143E+00	0.8147	0.7892
44	0.8902E+01	0.5000E+01	-0.6680E+03	0.1382E+02	0.6681E+03	0.5703E+03	-0.1185E+01	0.2902E+01	-0.9967E+00	0.8147	0.7707
45	0.8207E+01	0.5000E+01	-0.6796E+03	0.1422E+02	0.6797E+03	0.5703E+03	-0.1199E+01	0.2207E+01	-0.1329E+01	0.8147	0.7635
46	0.7627E+01	0.5000E+01	-0.6856E+03	0.1495E+02	0.6858E+03	0.5703E+03	-0.1249E+01	0.1627E+01	-0.1046E+01	0.8147	0.7597
47	0.7144E+01	0.5000E+01	-0.6893E+03	0.1585E+02	0.6895E+03	0.5703E+03	-0.1317E+01	0.1144E+01	-0.1056E+01	0.8147	0.7573
48	0.6742E+01	0.5000E+01	-0.6919E+03	0.1681E+02	0.6921E+03	0.5703E+03	-0.1392E+01	0.7419E+00	-0.1064E+01	0.8147	0.7556
49	0.6407E+01	0.5000E+01	-0.6941E+03	0.1777E+02	0.6944E+03	0.5703E+03	-0.1466E+01	0.4065E+00	-0.1077E+01	0.8147	0.7542
50	0.6127E+01	0.5000E+01	-0.6965E+03	0.1869E+02	0.6968E+03	0.5703E+03	-0.1537E+01	0.1270E+00	-0.1077E+01	0.8147	0.7527
51	0.5875E+01	0.5000E+01	-0.6975E+03	0.1961E+02	0.6978E+03	0.5695E+03	-0.1610E+01	-0.1250E+00	-0.1080E+01	0.8151	0.7520
52	0.5625E+01	0.5000E+01	-0.6994E+03	0.2060E+02	0.6997E+03	0.5685E+03	-0.1688E+01	-0.3750E+00	-0.1085E+01	0.8166	0.7508
53	0.5375E+01	0.5000E+01	-0.7037E+03	0.2171E+02	0.7040E+03	0.5662E+03	-0.1767E+01	-0.6250E+00	-0.1098E+01	0.8190	0.7480
54	0.5125E+01	0.5000E+01	-0.7149E+03	0.2295E+02	0.7153E+03	0.5633E+03	-0.1839E+01	-0.8750E+00	-0.1130E+01	0.8219	0.7407
55	0.4879E+01	0.5005E+01	-0.7357E+03	0.2435E+02	0.7361E+03	0.5587E+03	-0.1895E+01	-0.1121E+01	-0.1151E+01	0.8265	0.7271
56	0.4632E+01	0.5023E+01	-0.7313E+03	0.2568E+02	0.7318E+03	0.5495E+03	-0.2011E+01	-0.1369E+01	-0.1178E+01	0.8348	0.7300
57	0.4373E+01	0.5058E+01	-0.6944E+03	0.2689E+02	0.6949E+03	0.5361E+03	-0.2218E+01	-0.1630E+01	-0.1072E+01	0.8467	0.7539
58	0.4102E+01	0.5109E+01	-0.6445E+03	0.2809E+02	0.6452E+03	0.5185E+03	-0.2495E+01	-0.1906E+01	-0.9334E+00	0.8606	0.7849
59	0.3821E+01	0.5172E+01	-0.5916E+03	0.2933E+02	0.5923E+03	0.4984E+03	-0.2838E+01	-0.2194E+01	-0.7936E+00	0.8747	0.8163
60	0.3531E+01	0.5242E+01	-0.5414E+03	0.3067E+02	0.5423E+03	0.4774E+03	-0.3242E+01	-0.2493E+01	-0.6691E+00	0.8879	0.8442
61	0.3236E+01	0.5315E+01	-0.4978E+03	0.3213E+02	0.4988E+03	0.4574E+03	-0.3693E+01	-0.2795E+01	-0.5677E+00	0.8994	0.8670
62	0.2945E+01	0.5381E+01	-0.4630E+03	0.3373E+02	0.4642E+03	0.4400E+03	-0.4167E+01	-0.3094E+01	-0.4918E+00	0.9084	0.8840
63	0.2662E+01	0.5436E+01	-0.4384E+03	0.3548E+02	0.4398E+03	0.4261E+03	-0.4626E+01	-0.3383E+01	-0.4411E+00	0.9152	0.8954
64	0.2390E+01	0.5475E+01	-0.4255E+03	0.3742E+02	0.4271E+03	0.4159E+03	-0.5026E+01	-0.3658E+01	-0.4155E+00	0.9199	0.9011
65	0.2128E+01	0.5495E+01	-0.4281E+03	0.3966E+02	0.4299E+03	0.4096E+03	-0.5293E+01	-0.3920E+01	-0.4211E+00	0.9228	0.8999
66	0.1857E+01	0.5500E+01	-0.4525E+03	0.4230E+02	0.4545E+03	0.4061E+03	-0.5340E+01	-0.4161E+01	-0.4714E+00	0.9243	0.8886
67	0.1673E+01	0.5513E+01	-0.5159E+03	0.4521E+02	0.5182E+03	0.3989E+03	-0.5345E+01	-0.4572E+01	-0.6121E+00	0.9273	0.8570
68	0.1476E+01	0.5531E+01	-0.5395E+03	0.4827E+02	0.5419E+03	0.3932E+03	-0.5458E+01	-0.4762E+01	-0.6683E+00	0.9297	0.8444
69	0.1287E+01	0.5560E+01	-0.5571E+03	0.5497E+02	0.5598E+03	0.3850E+03	-0.5635E+01	-0.4945E+01	-0.7115E+00	0.9328	0.8346
70	0.1107E+01	0.5602E+01	-0.5678E+03	0.5852E+02	0.5708E+03	0.3761E+03	-0.5884E+01	-0.5122E+01	-0.7392E+00	0.9365	0.8285
71	0.9352E+00	0.5627E+01	-0.5708E+03	0.6213E+02	0.5742E+03	0.3648E+03	-0.6212E+01	-0.5293E+01	-0.7346E+00	0.9407	0.8266
72	0.7730E+00	0.5657E+01	-0.5708E+03	0.6575E+02	0.5691E+03	0.3519E+03	-0.6635E+01	-0.5460E+01	-0.7348E+00	0.9453	0.8295
73	0.6209E+00	0.5727E+01	-0.5652E+03	0.6932E+02	0.5561E+03	0.3379E+03	-0.7161E+01	-0.5624E+01	-0.7027E+00	0.9500	0.8367
74	0.4811E+00	0.5811E+01	-0.5518E+03	0.7277E+02	0.5350E+03	0.3230E+03	-0.7818E+01	-0.5783E+01	-0.6518E+00	0.9547	0.8481
75	0.3575E+00	0.5910E+01	-0.5300E+03	0.7608E+02	0.5066E+03	0.3078E+03	-0.8636E+01	-0.5855E+01	-0.5855E+00	0.9592	0.8630
76	0.2457E+00	0.6022E+01	-0.5009E+03	0.7917E+02	0.4715E+03	0.2923E+03	-0.9665E+01	-0.6096E+01	-0.5075E+00	0.9634	0.8805
77	0.1537E+00	0.6147E+01	-0.4648E+03	0.8198E+02	0.4302E+03	0.2773E+03	-0.1099E+02	-0.6249E+01	-0.4216E+00	0.9673	0.8998
78	0.8191E-01	0.6283E+01	-0.4223E+03	0.8443E+02	0.3823E+03	0.2620E+03	-0.1276E+02	-0.6401E+01	-0.3305E+00	0.9708	0.9202
79	0.3236E-01	0.6427E+01	-0.3728E+03	0.8636E+02	0.3214E+03	0.2493E+03	-0.1559E+02	-0.6552E+01	-0.2284E+00	0.9739	0.9431
80	0.6633E-02	0.6575E+01	-0.3096E+03	0.8787E+02	0.2621E+03	0.2354E+03	-0.1959E+02	-0.6919E+01	-0.1447E+00	0.9769	0.9619
81	0.	0.6741E+01	-0.2469E+03	0.8925E+02	0.2263E+03	0.2184E+03	-0.2323E+02	-0.6919E+01	-0.1015E+00	0.9802	0.9715
82	0.	0.6942E+01	-0.2079E+03	0.9056E+02	0.1992E+03	0.2003E+03	-0.2705E+02	-0.7160E+01	-0.7357E-01	0.9834	0.9779
83	0.	0.7183E+01	-0.1774E+03	0.9297E+02	0.1757E+03	0.1811E+03	-0.3115E+02	-0.7449E+01	-0.5340E-01	0.9865	0.9824
84	0.	0.7472E+01	-0.1519E+03	0.9180E+02	0.1597E+03	0.1613E+03	-0.3560E+02	-0.7796E+01	-0.3856E-01	0.9894	0.9857
85	0.	0.7819E+01	-0.1299E+03	0.9297E+02	0.1451E+03	0.1411E+03	-0.4040E+02	-0.8213E+01	-0.2752E-01	0.9919	0.9882
86	0.	0.8236E+01	-0.1105E+03	0.9405E+02	0.1332E+03	0.1212E+03	-0.4550E+02	-0.8712E+01	-0.1931E-01	0.9940	0.9901
87	0.	0.8736E+01	-0.9339E+02	0.9504E+02	0.1332E+03	0.1212E+03	-0.4550E+02	-0.8712E+01	-0.1931E-01	0.9940	0.9901

SHRQUD  
ON-BODY POINTS

88	0.	0.9335E+01	-0.7825E+02	0.9591E+02	0.1238E+03	0.1020E+03	-0.5079E+02	-0.9312E+01	-0.1327E-C1	0.9958	0.9914
89	0.	0.1006E+02	-0.6491E+02	0.9667E+02	0.1164E+03	0.8399E+02	-0.5612E+02	-0.1003E+02	-0.8870E-C2	0.9972	0.9924
90	0.	0.1092E+02	-0.5328E+02	0.9731E+02	0.1109E+03	0.6760E+02	-0.6130E+02	-0.1090E+02	-0.5756E-C2	0.9982	0.9931
91	0.	0.1187E+02	-0.4273E+02	0.9780E+02	0.1067E+03	0.5418E+02	-0.6640E+02	-0.1184E+02	-0.3467E-C2	0.9988	0.9936
92	0.	0.1282E+02	-0.3458E+02	0.9814E+02	0.1041E+03	0.4405E+02	-0.7059E+02	-0.128CE+02	-0.2062E-C2	0.9992	0.9939
93	0.	0.1378E+02	-0.2806E+02	0.9838E+02	0.1023E+03	0.3630E+02	-0.7408E+02	-0.1376E+02	-0.1163E-C2	0.9995	0.9941
94	0.	0.1474E+02	-0.2261E+02	0.9856E+02	0.1011E+03	0.3028E+02	-0.7708E+02	-0.1471E+02	-0.5614E-C3	0.9996	0.9943
95	0.	0.1569E+02	-0.1780E+02	0.9869E+02	0.1003E+03	0.2553E+02	-0.7978E+02	-0.1567E+02	-0.1421E-C3	0.9997	0.9944
96	0.	0.1665E+02	-0.1327E+02	0.9879E+02	0.9968E+02	0.2172E+02	-0.8235E+02	-0.1663E+02	0.1601E-C3	0.9998	0.9944
97	0.	0.1761E+02	-0.8563E+01	0.9886E+02	0.9923E+02	0.1864E+02	-0.8505E+02	-0.1758E+02	0.3808E-C3	0.9999	0.9945
98	0.	0.1856E+02	-0.2716E+01	0.9891E+02	0.9895E+02	0.1612E+02	-0.8843E+02	-0.1854E+02	0.5204E-C3	0.9999	0.9945
99	0.	0.1952E+02	0.8712E+01	0.1017E+03	0.1021E+03	0.1403E+02	0.8511E+02	-0.1950E+02	-0.1064E-C2	0.9960	0.9942

## OFF-BODY POINTS (RAKES)

I	COORDINATES			* VELOCITIES * *-----*										PRESS. RATIO		
	AXIAL	RADIAL	Y	AXIAL	VX	RADIAL	VY	CIRCUMFNTL	RESULTANT	MERIDIONAL	CHORDWISE	SPANWISE	VSPAN	RHOBR	COMP	PSOPTC
1	2.0000E+00	1.9996E+00	4.2990E+02	7.3708E+01	7.9457E+01	4.4335E+02	4.3617E+02	4.3617E+02	4.3617E+02	7.9457E+01	7.3708E+01	0.8938				
2	2.0000E+00	2.5000E+00	4.2878E+02	3.9436E+01	6.4917E+01	4.3546E+02	4.3059E+02	4.3059E+02	4.3059E+02	6.4917E+01	3.9436E+01	0.9237				
3	2.0000E+00	3.0000E+00	4.3218E+02	8.0010E+00	5.7380E+01	4.3605E+02	4.3226E+02	4.3226E+02	4.3226E+02	5.7380E+01	8.0010E+00	0.8974				
4	2.0000E+00	3.5000E+00	4.3745E+02	-1.8056E+01	5.2841E+01	4.4100E+02	4.3782E+02	4.3782E+02	4.3782E+02	5.2841E+01	-1.8056E+01	0.9237				
5	2.0000E+00	4.0000E+00	4.4344E+02	-3.8035E+01	4.6515E+01	4.4783E+02	4.4507E+02	4.4507E+02	4.4507E+02	4.6515E+01	-3.8035E+01	0.8949				
6	2.0000E+00	4.5000E+00	4.4913E+02	-6.9533E+01	4.6980E+01	4.5429E+02	4.5185E+02	4.5185E+02	4.5185E+02	4.6980E+01	-6.9533E+01	0.8877				
7	4.0000E+00	5.0000E+00	4.5163E+02	-6.5794E+01	4.4272E+01	4.5610E+02	4.5395E+02	4.5395E+02	4.5395E+02	4.4272E+01	-6.5794E+01	0.8879				
8	4.0000E+00	5.4981E+00	4.3891E+02	-1.0132E+01	4.0972E+01	4.4093E+02	4.3903E+02	4.3903E+02	4.3903E+02	4.0972E+01	-1.0132E+01	0.8949				
9	4.0000E+00	2.3258E+00	5.8016E+02	4.2799E+01	5.3865E+01	5.8844E+02	5.8597E+02	5.8597E+02	5.8597E+02	5.3865E+01	4.2799E+01	0.8185				
10	4.0000E+00	3.0000E+00	5.8076E+02	2.4428E+01	4.2249E+01	5.8280E+02	5.8127E+02	5.8127E+02	5.8127E+02	4.2249E+01	2.4428E+01	0.8658				
11	4.0000E+00	3.2500E+00	5.8211E+02	8.0880E+00	3.9567E+01	5.8351E+02	5.8217E+02	5.8217E+02	5.8217E+02	3.9567E+01	8.0880E+00	0.8658				
12	4.0000E+00	3.5000E+00	5.8421E+02	-0.9706E+00	3.7368E+01	5.8544E+02	5.8425E+02	5.8425E+02	5.8425E+02	3.7368E+01	-0.9706E+00	0.8202				
13	4.0000E+00	3.7500E+00	5.8710E+02	-2.1433E+01	3.5516E+01	5.8856E+02	5.8749E+02	5.8749E+02	5.8749E+02	3.5516E+01	-2.1433E+01	0.8185				
14	4.0000E+00	4.0000E+00	5.9087E+02	-3.6014E+01	3.3919E+01	5.9294E+02	5.9197E+02	5.9197E+02	5.9197E+02	3.3919E+01	-3.6014E+01	0.8159				
15	4.0000E+00	4.5000E+00	6.0123E+02	-6.9235E+01	3.2513E+01	5.9870E+02	5.9781E+02	5.9781E+02	5.9781E+02	3.2513E+01	-6.9235E+01	0.8658				
16	4.0000E+00	5.1310E+00	6.1011E+02	-1.3482E+01	3.0111E+01	6.1489E+02	6.1416E+02	6.1416E+02	6.1416E+02	3.0111E+01	-1.3482E+01	0.8031				
17	6.0000E+00	2.4990E+00	7.1825E+02	7.5409E+00	3.6269E+01	7.1921E+02	7.1829E+02	7.1829E+02	7.1829E+02	3.6269E+01	7.5409E+00	0.7968				
18	6.0000E+00	3.0000E+00	7.0202E+02	8.7845E+00	3.0319E+01	7.1027E+02	7.0951E+02	7.0951E+02	7.0951E+02	3.0319E+01	8.7845E+00	0.8149				
19	6.0000E+00	3.2500E+00	6.9795E+02	6.3127E+00	2.8180E+01	6.9855E+02	6.9798E+02	6.9798E+02	6.9798E+02	2.8180E+01	6.3127E+00	0.7515				
20	6.0000E+00	3.5000E+00	6.9609E+02	3.6677E+00	2.6391E+01	6.9660E+02	6.9610E+02	6.9610E+02	6.9610E+02	2.6391E+01	3.6677E+00	0.8149				
21	6.0000E+00	3.7500E+00	6.9583E+02	1.3363E+01	2.4854E+01	6.9672E+02	6.9583E+02	6.9583E+02	6.9583E+02	2.4854E+01	1.3363E+01	0.8149				
22	6.0000E+00	4.0000E+00	6.9671E+02	-0.0151E-01	2.3504E+01	6.9710E+02	6.9671E+02	6.9671E+02	6.9671E+02	2.3504E+01	-0.0151E-01	0.7525				
23	6.0000E+00	4.2500E+00	6.9830E+02	-1.3644E+00	2.2291E+01	6.9865E+02	6.9830E+02	6.9830E+02	6.9830E+02	2.2291E+01	-1.3644E+00	0.8149				
24	6.0000E+00	4.5000E+00	7.0012E+02	-1.4764E+01	2.1180E+01	7.0044E+02	7.0012E+02	7.0012E+02	7.0012E+02	2.1180E+01	-1.4764E+01	0.7503				
	6.0000E+00	4.7500E+00	7.0167E+02	-8.5264E-01	2.0144E+01	7.0196E+02	7.0167E+02	7.0167E+02	7.0167E+02	2.0144E+01	-8.5264E-01	0.7493				
	6.0000E+00	5.0000E+00	6.9690E+02	0.	-1.9139E+01	6.9717E+02	6.9690E+02	6.9690E+02	6.9690E+02	-1.9139E+01	5.8932E-07	0.7524				

I	COORDINATES			NEW	CP	*--ANGLES--*									
	AXIAL	RADIAL	Y			VORI	ALPHA	FLOW	UNDERTURNING	SPANWISE	SWIRL	QFRACT			
	2.0000E+00	1.9996E+00		-4.4825E-01	9.7290E+00	1.5731E+00	1.0472E+01	9.7290E+00	1.0472E+01	0.					
1	2.0000E+00	2.5000E+00	4.0744E+02	-4.3219E-01	5.2549E+00	8.5735E+00	8.6091E+00	5.2549E+00	8.6091E+00	8.3696E-02					
2	2.0000E+00	3.0000E+00	4.0744E+02	-4.3338E-01	1.0606E+00	7.5615E+00	7.5628E+00	1.0606E+00	7.5628E+00	1.8635E-01					
3	2.0000E+00	3.5000E+00	4.0744E+02	-4.4344E-01	-2.3636E+00	6.8818E+00	6.8876E+00	-2.3636E+00	6.8876E+00	3.0877E-01					
4	2.0000E+00	4.0000E+00	4.0744E+02	-4.5746E-01	-4.9024E+00	6.3656E+00	6.3887E+00	-4.9024E+00	6.3887E+00	4.5155E-01					
5	2.0000E+00	4.5000E+00	4.0744E+02	-4.7089E-01	-6.2936E+00	5.9359E+00	5.9716E+00	-6.2936E+00	5.9716E+00	6.1509E-01					
6	2.0000E+00	5.0000E+00	4.0744E+02	-4.7470E-01	-5.7898E+00	5.5702E+00	5.5986E+00	-5.7898E+00	5.5986E+00	7.9923E-01					
	2.0000E+00	5.4981E+00		-4.4330E-01	1.3224E+00	5.3316E+00	5.3330E+00	-1.3224E+00	5.3330E+00	1.0000E+00					
4	4.0000E+00	2.3258E+00		-7.8374E-01	7.9354E+00	5.2521E+00	5.3026E+00	7.9354E+00	5.3026E+00	0.					
7	4.0000E+00	2.7500E+00	5.1133E+02	-7.7120E-01	4.2191E+00	4.4837E+00	4.4958E+00	4.2191E+00	4.4958E+00	1.0135E-01					
8	4.0000E+00	3.0000E+00	5.1133E+02	-7.6938E-01	2.4085E+00	4.1571E+00	4.1608E+00	2.4085E+00	4.1608E+00	1.6914E-01					
9	4.0000E+00	3.2500E+00	5.1133E+02	-7.7117E-01	7.9603E-01	3.8881E+00	3.8885E+00	7.9603E-01	3.8885E+00	2.4294E-01					
10	4.0000E+00	3.5000E+00	5.1133E+02	-7.7609E-01	-6.8361E-01	3.6596E+00	3.6598E+00	-6.8361E-01	3.6598E+00	3.2283E-01					
11	4.0000E+00	3.7500E+00	5.1133E+02	-7.8405E-01	-2.0908E+00	3.4596E+00	3.4618E+00	-2.0908E+00	3.4618E+00	4.0890E-01					
12	4.0000E+00	4.0000E+00	5.1133E+02	-7.9525E-01	-3.4879E+00	3.2795E+00	3.2855E+00	-3.4879E+00	3.2855E+00	5.0126E-01					
13	4.0000E+00	4.2500E+00	5.1133E+02	-8.1010E-01	-4.9485E+00	3.1131E+00	3.1247E+00	-4.9485E+00	3.1247E+00	6.0003E-01					
14	4.0000E+00	4.5000E+00	5.1133E+02	-8.2909E-01	-6.5690E+00	2.9652E+00	2.9757E+00	-6.5690E+00	2.9757E+00	7.0535E-01					
15	4.0000E+00	4.7500E+00	5.1133E+02	-8.5238E-01	-8.4829E+00	2.8069E+00	2.8379E+00	-8.4829E+00	2.8379E+00	8.1732E-01					
4	4.0000E+00	5.1310E+00		-8.8042E-01	-1.2461E+01	-2.6141E+00	-2.6771E+00	-1.2461E+01	-2.6771E+00	1.0000E+00					

	6.0000E+00	2.4990E+00	5.7015E+02	-1.1417E+00	6.0152E-01	2.8906E+00	2.8907E+00	6.0152E-01	2.8907E+00	0.
16	6.0000E+00	2.7500E+00	5.7015E+02	-1.1159E+00	8.0635E-01	2.6589E+00	2.6592E+00	8.0635E-01	2.6592E+00	7.1003E-02
17	6.0000E+00	3.0000E+00	5.7015E+02	-1.0942E+00	7.1692E-01	2.4728E+00	2.4730E+00	7.1692E-01	2.4730E+00	1.4798E-01
18	6.0000E+00	3.2500E+00	5.7015E+02	-1.0822E+00	5.1821E-01	2.3120E+00	2.3121E+00	5.1821E-01	2.3121E+00	2.3121E-01
19	6.0000E+00	3.5000E+00	5.7015E+02	-1.0767E+00	3.0189E-01	2.1712E+00	2.1712E+00	3.0189E-01	2.1712E+00	3.2103E-01
20	6.0000E+00	3.7500E+00	5.7015E+02	-1.0757E+00	1.1003E-01	2.0457E+00	2.0457E+00	1.1003E-01	2.0457E+00	4.1736E-01
21	6.0000E+00	4.0000E+00	5.7015E+02	-1.0731E+00	-3.3019E-02	1.9322E+00	1.9322E+00	-3.3019E-02	1.9322E+00	5.2039E-01
22	6.0000E+00	4.2500E+00	5.7015E+02	-1.0825E+00	-1.1195E-01	1.8284E+00	1.8284E+00	-1.1195E-01	1.8284E+00	6.3011E-01
23	6.0000E+00	4.5000E+00	5.7015E+02	-1.0876E+00	-1.2082E-01	1.7328E+00	1.7328E+00	-1.2082E-01	1.7328E+00	7.4669E-01
24	6.0000E+00	4.7500E+00	5.7015E+02	-1.0920E+00	-6.9623E-02	1.6444E+00	1.6444E+00	-6.9623E-02	1.6444E+00	8.7010E-01
	6.0000E+00	5.0000E+00	5.7015E+02	-1.0783E+00	0.	-1.5731E+00	-1.5731E+00	4.8451E-08	-1.5731E+00	1.0000E+00

# RELATIVE ROTOR INLET DATA

X = 6.0000 UTIP = 900.0000

Y	U	VZPRIME	VPRIM	MPRIME	BETAPR	VZPRST	VPRST	MPRS	BETAPS
2.4990E+00	4.4982E+02	-4.1355E+02	8.2804E+02	7.7564E-01	-2.9931E+01	-4.8609E+02	8.6731E+02	8.1164E-01	-3.4087E+01
2.7500E+00	4.9500E+02	-4.6205E+02	8.4670E+02	7.9147E-01	-3.3073E+01	-5.2795E+02	8.8438E+02	8.2670E-01	-3.6653E+01
3.0000E+00	5.4000E+02	-5.0968E+02	8.6757E+02	8.1023E-01	-3.5978E+01	-5.7032E+02	9.0453E+02	8.4474E-01	-3.9088E+01
3.2500E+00	5.8500E+02	-5.5682E+02	8.9287E+02	8.3343E-01	-3.8582E+01	-6.1318E+02	9.2906E+02	8.6721E-01	-4.1300E+01
3.5000E+00	6.3000E+02	-6.0361E+02	9.2136E+02	8.5982E-01	-4.0930E+01	-6.5639E+02	9.5677E+02	8.9286E-01	-4.3318E+01
3.7500E+00	6.7500E+02	-6.5015E+02	9.5230E+02	8.8865E-01	-4.3056E+01	-6.9985E+02	9.8690E+02	9.2094E-01	-4.5165E+01
4.0000E+00	7.2000E+02	-6.9650E+02	9.8514E+02	9.1940E-01	-4.4991E+01	-7.4350E+02	1.0189E+03	9.5052E-01	-4.6861E+01
4.2500E+00	7.6500E+02	-7.4271E+02	1.0194E+03	9.5157E-01	-4.6765E+01	-7.8729E+02	1.0524E+03	9.8231E-01	-4.8428E+01
4.5000E+00	8.1000E+02	-7.8882E+02	1.0547E+03	9.8472E-01	-4.8409E+01	-8.3118E+02	1.0868E+03	1.0146E+00	-4.9892E+01
4.7500E+00	8.5500E+02	-8.3486E+02	1.0906E+03	1.0184E+00	-4.9954E+01	-8.7514E+02	1.1217E+03	1.0475E+00	-5.1278E+01
5.0000E+00	9.0000E+02	-9.1914E+02	1.1535E+03	1.0765E+00	-5.2830E+01	-8.8086E+02	1.1232E+03	1.0483E+00	-5.1650E+01

# RAKE WEIGHT FLOW DATA

I	X	(Q(I)-QBAR)/QBAR	QS TOT	QFR
1	2.0000E+00	-1.4958E-03	1.7823E+01	1.0000E+00
2	4.0000E+00	4.6178E-04	1.7858E+01	1.0000E+00
3	6.0000E+00	0.	1.7849E+01	1.0000E+00

# STREAMLINES

X	YSTRM
2.0000E-02	2.1267E+00
4.0000E-02	2.2491E+00
6.0000E-02	2.3667E+00
8.0000E-02	2.4796E+00
1.0000E-01	2.5843E+00
1.2000E-01	2.6852E+00
1.4000E-01	2.7833E+00
1.6000E-01	2.8788E+00
1.8000E-01	2.9712E+00
2.0000E-01	3.0590E+00
2.2000E-01	3.1439E+00
2.4000E-01	3.2272E+00
2.6000E-01	3.3086E+00
2.8000E-01	3.3883E+00
3.0000E-01	3.4663E+00
3.2000E-01	3.5414E+00
3.4000E-01	3.6144E+00
3.6000E-01	3.6862E+00

3.80000E-01	3.75683E+00
4.00000E-01	3.82630E+00
4.20000E-01	3.89461E+00
4.40000E-01	3.96176E+00
4.60000E-01	4.02713E+00
4.80000E-01	4.09077E+00
5.00000E-01	4.15362E+00
5.20000E-01	4.21568E+00
5.40000E-01	4.27696E+00
5.60000E-01	4.33745E+00
5.80000E-01	4.39716E+00
6.00000E-01	4.45607E+00
6.20000E-01	4.51387E+00
6.40000E-01	4.57006E+00
6.60000E-01	4.62576E+00
6.80000E-01	4.68097E+00
7.00000E-01	4.73569E+00
7.20000E-01	4.78993E+00
7.40000E-01	4.84368E+00
7.60000E-01	4.89694E+00
7.80000E-01	4.94972E+00
8.00000E-01	5.00200E+00
8.20000E-01	5.05381E+00
8.40000E-01	5.10512E+00
8.60000E-01	5.15595E+00
8.80000E-01	5.20629E+00
9.00000E-01	5.25614E+00
9.20000E-01	5.30551E+00
9.40000E-01	5.35439E+00
9.60000E-01	5.40278E+00
9.80000E-01	5.45068E+00
1.00000E+00	5.49810E+00

X = 4.000

QSTRM	YSTRM
2.00000E-02	2.41430E+00
4.00000E-02	2.50044E+00
6.00000E-02	2.58422E+00
8.00000E-02	2.66565E+00
1.00000E-01	2.74473E+00
1.20000E-01	2.82071E+00
1.40000E-01	2.89492E+00
1.60000E-01	2.96743E+00
1.80000E-01	3.03794E+00
2.00000E-01	3.10677E+00
2.20000E-01	3.17425E+00
2.40000E-01	3.24038E+00
2.60000E-01	3.30483E+00
2.80000E-01	3.36811E+00
3.00000E-01	3.43031E+00
3.20000E-01	3.49143E+00
3.40000E-01	3.55117E+00
3.60000E-01	3.60997E+00
3.80000E-01	3.66788E+00
4.00000E-01	3.72490E+00
4.20000E-01	3.78087E+00
4.40000E-01	3.83593E+00
4.60000E-01	3.89025E+00
4.80000E-01	3.94384E+00
5.00000E-01	3.99670E+00

5.20000E-01 4.04859E+00  
 5.40000E-01 4.09985E+00  
 5.60000E-01 4.15049E+00  
 5.80000E-01 4.20052E+00  
 6.00000E-01 4.24993E+00  
 6.20000E-01 4.29851E+00  
 6.40000E-01 4.34657E+00  
 6.60000E-01 4.39412E+00  
 6.80000E-01 4.44114E+00  
 7.00000E-01 4.48765E+00  
 7.20000E-01 4.53342E+00  
 7.40000E-01 4.57870E+00  
 7.60000E-01 4.62359E+00  
 7.80000E-01 4.66807E+00  
 8.00000E-01 4.71215E+00  
 8.20000E-01 4.75584E+00  
 8.40000E-01 4.79912E+00  
 8.60000E-01 4.84201E+00  
 8.80000E-01 4.88450E+00  
 9.00000E-01 4.92658E+00  
 9.20000E-01 4.96827E+00  
 9.40000E-01 5.00956E+00  
 9.60000E-01 5.05045E+00  
 9.80000E-01 5.09095E+00  
 1.00000E+00 5.13104E+00

X = 6.000

QSTRM	YSTRM
2.00000E-02	2.57167E+00
4.00000E-02	2.64281E+00
6.00000E-02	2.71239E+00
8.00000E-02	2.78016E+00
1.00000E-01	2.84631E+00
1.20000E-01	2.91123E+00
1.40000E-01	2.97492E+00
1.60000E-01	3.03714E+00
1.80000E-01	3.09814E+00
2.00000E-01	3.15815E+00
2.20000E-01	3.21716E+00
2.40000E-01	3.27501E+00
2.60000E-01	3.33179E+00
2.80000E-01	3.38775E+00
3.00000E-01	3.44289E+00
3.20000E-01	3.49722E+00
3.40000E-01	3.55047E+00
3.60000E-01	3.60302E+00
3.80000E-01	3.65490E+00
4.00000E-01	3.70611E+00
4.20000E-01	3.75660E+00
4.40000E-01	3.80624E+00
4.60000E-01	3.85532E+00
4.80000E-01	3.90383E+00
5.00000E-01	3.95178E+00
5.20000E-01	3.99917E+00
5.40000E-01	4.04579E+00
5.60000E-01	4.09194E+00
5.80000E-01	4.13762E+00
6.00000E-01	4.18283E+00
6.20000E-01	4.22756E+00
6.40000E-01	4.27173E+00

6.60000E-01 4.31538E+00  
6.80000E-01 4.35863E+00  
7.00000E-01 4.40149E+00  
7.20000E-01 4.44396E+00  
7.40000E-01 4.48602E+00  
7.60000E-01 4.52755E+00  
7.80000E-01 4.56868E+00  
8.00000E-01 4.60949E+00  
8.20000E-01 4.64998E+00  
8.40000E-01 4.69015E+00  
8.60000E-01 4.73000E+00  
8.80000E-01 4.76953E+00  
9.00000E-01 4.80874E+00  
9.20000E-01 4.84763E+00  
9.40000E-01 4.88621E+00  
9.60000E-01 4.92446E+00  
9.80000E-01 4.96239E+00  
1.00000E+00 5.00000E+00

3 OF 3 THETAS

THETA = 0.18000E+03 WDOIT = 1.82949E+01 VICT = 5.84508E+02 V3 = -1.42602E-01

HUB  
ON-BODY POINTS

I	X	Y	VP	VTHTA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC
1	0.	0.1250E+00	-0.7702E+02	0.2807E-05	0.7702E+02	0.2412E+03	-0.2088E-05	-0.7153E+01	0.1016E-01	0.9756	0.9967
2	-0.	0.3750E+00	-0.5609E+02	0.2821E-05	0.5609E+02	0.2412E+03	-0.2088E-05	-0.6903E+01	0.1712E-01	0.9756	0.9982
3	0.	0.8379E-02	-0.2156E+02	0.2877E-05	0.2156E+02	0.2565E+03	-0.1764E-05	-0.6652E+01	0.2384E-01	0.9723	0.9997
4	0.	0.4613E-01	0.4277E+02	0.2972E-05	0.4277E+02	0.2737E+03	0.3981E-05	-0.6418E+01	0.2042E-01	0.9682	0.9990
5	0.	0.1267E+00	0.1106E+03	0.3047E-05	0.1106E+03	0.2941E+03	0.1579E-05	-0.6202E+01	-0.5545E-02	0.9630	0.9931
6	0.	0.2473E+00	0.1758E+03	0.3083E-05	0.1758E+03	0.3156E+03	0.1005E-05	-0.5986E+01	-0.5197E-01	0.9569	0.9827
7	0.	0.3999E+00	0.2337E+03	0.3085E-05	0.2337E+03	0.3366E+03	0.7565E-06	-0.5768E+01	-0.1103E+00	0.9504	0.9696
8	0.	0.5738E+00	0.2831E+03	0.3061E-05	0.2831E+03	0.3561E+03	0.6194E-06	-0.5549E+01	-0.1726E+00	0.9438	0.9557
9	0.	0.7639E+00	0.3253E+03	0.3016E-05	0.3253E+03	0.3732E+03	0.5313E-06	-0.5329E+01	-0.2344E+00	0.9376	0.9418
10	0.	0.9693E+00	0.3621E+03	0.2954E-05	0.3621E+03	0.3875E+03	0.4675E-06	-0.5103E+01	-0.2949E+00	0.9320	0.9282
11	0.	0.1186E+01	0.3933E+03	0.2878E-05	0.3933E+03	0.3989E+03	0.4194E-06	-0.4871E+01	-0.3505E+00	0.9274	0.9157
12	0.	0.1412E+01	0.4184E+03	0.2791E-05	0.4184E+03	0.4071E+03	0.3822E-06	-0.4636E+01	-0.3982E+00	0.9239	0.9050
13	0.	0.1643E+01	0.4370E+03	0.2694E-05	0.4370E+03	0.4125E+03	0.3532E-06	-0.4398E+01	-0.4353E+00	0.9215	0.8967
14	0.	0.1880E+01	0.4493E+03	0.2590E-05	0.4493E+03	0.4161E+03	0.3303E-06	-0.4157E+01	-0.4605E+00	0.9199	0.8911
15	0.	0.2125E+01	0.4590E+03	0.2481E-05	0.4590E+03	0.4197E+03	0.3097E-06	-0.3908E+01	-0.4807E+00	0.9182	0.8865
16	0.	0.2375E+01	0.4719E+03	0.2370E-05	0.4719E+03	0.4259E+03	0.2877E-06	-0.3655E+01	-0.5084E+00	0.9154	0.8803
17	0.	0.2625E+01	0.4881E+03	0.2260E-05	0.4881E+03	0.4351E+03	0.2653E-06	-0.3402E+01	-0.5438E+00	0.9109	0.8724
18	0.	0.2875E+01	0.5063E+03	0.2153E-05	0.5063E+03	0.4472E+03	0.2437E-06	-0.3148E+01	-0.5847E+00	0.9048	0.8632
19	0.	0.3125E+01	0.5265E+03	0.2050E-05	0.5265E+03	0.4617E+03	0.2231E-06	-0.2895E+01	-0.6311E+00	0.8970	0.8526
20	0.	0.3375E+01	0.5500E+03	0.1952E-05	0.5500E+03	0.4783E+03	0.2034E-06	-0.2641E+01	-0.6878E+00	0.8874	0.8401
21	0.	0.3625E+01	0.5767E+03	0.1860E-05	0.5767E+03	0.4963E+03	0.1848E-06	-0.2388E+01	-0.7539E+00	0.8761	0.8252
22	0.	0.3874E+01	0.6034E+03	0.1774E-05	0.6034E+03	0.5148E+03	0.1685E-06	-0.2136E+01	-0.8224E+00	0.8633	0.8098
23	0.	0.4123E+01	0.6288E+03	0.1694E-05	0.6288E+03	0.5329E+03	0.1543E-06	-0.1884E+01	-0.8892E+00	0.8494	0.7949
24	0.	0.4373E+01	0.6539E+03	0.1618E-05	0.6539E+03	0.5495E+03	0.1418E-06	-0.1632E+01	-0.9572E+00	0.8352	0.7796
25	0.	0.4623E+01	0.6783E+03	0.1546E-05	0.6783E+03	0.5632E+03	0.1306E-06	-0.1390E+01	-0.1025E+01	0.8221	0.7644
26	0.	0.4874E+01	0.7004E+03	0.1473E-05	0.7004E+03	0.5725E+03	0.1205E-06	-0.1128E+01	-0.1088E+01	0.8124	0.7503
27	0.	0.5125E+01	0.7193E+03	0.1401E-05	0.7193E+03	0.5774E+03	0.1116E-06	-0.8767E+00	-0.1142E+01	0.8070	0.7381
28	0.	0.5375E+01	0.7359E+03	0.1331E-05	0.7359E+03	0.5803E+03	0.1037E-06	-0.6252E+00	-0.1190E+01	0.8035	0.7272
29	0.	0.5626E+01	0.7499E+03	0.1267E-05	0.7499E+03	0.5827E+03	0.9678E-07	-0.3743E+00	-0.1232E+01	0.8008	0.7180
30	0.	0.5875E+01	0.7543E+03	0.1206E-05	0.7543E+03	0.5841E+03	0.9157E-07	-0.1243E+00	-0.1243E+01	0.7991	0.7151
31	0.	0.6127E+01	0.7449E+03	0.1147E-05	0.7449E+03	0.5845E+03	0.8822E-07	0.1270E+00	-0.1217E+01	0.7986	0.7213
32	0.	0.6407E+01	0.7339E+03	0.1089E-05	0.7339E+03	0.5845E+03	0.8505E-07	0.4065E+00	-0.1185E+01	0.7986	0.7286



SHROUD ON-BODY POINTS														PSOPTC	
I	X	Y	VP	VTHETA	VRES	VBARI	BETA	S	CPC	RB/RT	PSOPTC				
333	0.6742E+01	0.2500E+01	0.7279E+03	0.1031E-05	0.7279E+03	0.5845E+03	0.8114E-07	0.7419E+00	-0.1167E+01	0.7986	0.7326				
334	0.7144E+01	0.2500E+01	0.7232E+03	0.9723E-06	0.7232E+03	0.5845E+03	0.7703E-07	0.1144E+01	-0.1153E+01	0.7986	0.7356				
335	0.7627E+01	0.2500E+01	0.7189E+03	0.9173E-06	0.7189E+03	0.5845E+03	0.7311E-07	0.1627E+01	-0.1141E+01	0.7986	0.7384				
336	0.8207E+01	0.2500E+01	0.7145E+03	0.8717E-06	0.7145E+03	0.5845E+03	0.6990E-07	0.2207E+01	-0.1128E+01	0.7986	0.7413				
337	0.8902E+01	0.2500E+01	0.7098E+03	0.8438E-06	0.7098E+03	0.5845E+03	0.6811E-07	0.2902E+01	-0.1115E+01	0.7986	0.7443				
338	0.9737E+01	0.2500E+01	0.7028E+03	0.8438E-06	0.7028E+03	0.5845E+03	0.6879E-07	0.3737E+01	-0.1094E+01	0.7986	0.7488				
339	0.1064E+02	0.2500E+01	0.6857E+03	0.8709E-06	0.6857E+03	0.5845E+03	0.7277E-07	0.4644E+01	-0.1046E+01	0.7986	0.7597				
340	0.1155E+02	0.2500E+01	0.3683E+03	0.8932E-06	0.3683E+03	0.5845E+03	0.1296E-06	0.5548E+01	-0.3056E+00	0.7986	0.9258				
441	0.1155E+02	0.5000E+01	-0.1690E+02	0.5305E-06	0.1690E+02	0.5845E+03	-0.1798E-05	0.5548E+01	0.2428E-01	0.7986	0.9998				
442	0.1064E+02	0.5000E+01	-0.5570E+03	0.4873E-06	0.5570E+03	0.5845E+03	-0.5013E-07	0.4644E+01	-0.7049E+00	0.7986	0.8362				
443	0.9737E+01	0.5000E+01	-0.6399E+03	0.4506E-06	0.6399E+03	0.5845E+03	-0.4035E-07	0.3737E+01	-0.9150E+00	0.7986	0.7882				
444	0.8902E+01	0.5000E+01	-0.6777E+03	0.4453E-06	0.6777E+03	0.5845E+03	-0.3765E-07	0.2902E+01	-0.1023E+01	0.7986	0.7648				
445	0.8207E+01	0.5000E+01	-0.6945E+03	0.4590E-06	0.6945E+03	0.5845E+03	-0.3787E-07	0.2207E+01	-0.1071E+01	0.7986	0.7542				
446	0.7627E+01	0.5000E+01	-0.7047E+03	0.4832E-06	0.7047E+03	0.5845E+03	-0.3928E-07	0.1627E+01	-0.1100E+01	0.7986	0.7476				
447	0.7144E+01	0.5000E+01	-0.7120E+03	0.5126E-06	0.7120E+03	0.5845E+03	-0.4125E-07	0.1144E+01	-0.1121E+01	0.7986	0.7429				
448	0.6742E+01	0.5000E+01	-0.7178E+03	0.5441E-06	0.7178E+03	0.5845E+03	-0.4343E-07	0.7419E+00	-0.1138E+01	0.7986	0.7391				
449	0.6407E+01	0.5000E+01	-0.7229E+03	0.5755E-06	0.7229E+03	0.5845E+03	-0.4562E-07	0.4065E+00	-0.1152E+01	0.7986	0.7358				
450	0.6127E+01	0.5000E+01	-0.7279E+03	0.6058E-06	0.7279E+03	0.5845E+03	-0.4768E-07	0.1270E+00	-0.1167E+01	0.7986	0.7325				
451	0.5879E+01	0.5000E+01	-0.7311E+03	0.6358E-06	0.7311E+03	0.5845E+03	-0.4983E-07	0.1250E+00	-0.1176E+01	0.7991	0.7304				
452	0.5625E+01	0.5000E+01	-0.7353E+03	0.6685E-06	0.7353E+03	0.5871E+03	-0.5209E-07	0.3750E+00	-0.1189E+01	0.8008	0.7277				
453	0.5375E+01	0.5000E+01	-0.7420E+03	0.7045E-06	0.7420E+03	0.5803E+03	-0.5440E-07	0.6250E+00	-0.1208E+01	0.8035	0.7232				
454	0.5128E+01	0.5000E+01	-0.7552E+03	0.7449E-06	0.7552E+03	0.5774E+03	-0.5652E-07	0.8750E+00	-0.1248E+01	0.8070	0.7144				
455	0.4879E+01	0.5005E+01	-0.7816E+03	0.7908E-06	0.7816E+03	0.5726E+03	-0.5797E-07	-0.1121E+01	-0.1327E+01	0.8122	0.6967				
456	0.4632E+01	0.5023E+01	-0.7823E+03	0.8341E-06	0.7823E+03	0.5636E+03	-0.6109E-07	-0.1369E+01	-0.1325E+01	0.8217	0.6962				
457	0.4373E+01	0.5058E+01	-0.7463E+03	0.8721E-06	0.7463E+03	0.5495E+03	-0.6696E-07	-0.1630E+01	-0.1221E+01	0.8352	0.7204				
458	0.4102E+01	0.5109E+01	-0.6962E+03	0.9090E-06	0.6962E+03	0.5314E+03	-0.7481E-07	-0.1906E+01	-0.1075E+01	0.8506	0.7531				
459	0.3821E+01	0.5172E+01	-0.6427E+03	0.9474E-06	0.6427E+03	0.5108E+03	-0.8447E-07	-0.2194E+01	-0.9266E+00	0.8662	0.7865				
460	0.3531E+01	0.5242E+01	-0.5922E+03	0.9891E-06	0.5922E+03	0.4893E+03	-0.9570E-07	-0.2493E+01	-0.7934E+00	0.8806	0.8164				
461	0.3236E+01	0.5315E+01	-0.5487E+03	0.1035E-05	0.5487E+03	0.4688E+03	-0.1081E-06	-0.2793E+01	-0.6847E+00	0.8930	0.8407				
462	0.2945E+01	0.5381E+01	-0.5146E+03	0.1086E-05	0.5146E+03	0.4510E+03	-0.1209E-06	-0.3094E+01	-0.6039E+00	0.9028	0.8589				
463	0.2662E+01	0.5436E+01	-0.4915E+03	0.1141E-05	0.4915E+03	0.4367E+03	-0.1331E-06	-0.3383E+01	-0.5513E+00	0.9101	0.8707				
464	0.2380E+01	0.5475E+01	-0.4810E+03	0.1204E-05	0.4810E+03	0.4263E+03	-0.1434E-06	-0.3658E+01	-0.5282E+00	0.9151	0.8759				
465	0.2128E+01	0.5495E+01	-0.4872E+03	0.1276E-05	0.4872E+03	0.4198E+03	-0.1501E-06	-0.3920E+01	-0.5417E+00	0.9182	0.8728				
466	0.1887E+01	0.5500E+01	-0.5213E+03	0.1363E-05	0.5213E+03	0.4162E+03	-0.1498E-06	-0.4161E+01	-0.6194E+00	0.9198	0.8554				
467	0.1673E+01	0.5504E+01	-0.5723E+03	0.1461E-05	0.5723E+03	0.4131E+03	-0.1462E-06	-0.4373E+01	-0.7434E+00	0.9212	0.8276				
468	0.1476E+01	0.5513E+01	-0.6157E+03	0.1563E-05	0.6157E+03	0.4089E+03	-0.1455E-06	-0.4572E+01	-0.8544E+00	0.9231	0.8027				
469	0.1287E+01	0.5531E+01	-0.6557E+03	0.1672E-05	0.6557E+03	0.4030E+03	-0.1461E-06	-0.4762E+01	-0.9622E+00	0.9256	0.7785				
470	0.1107E+01	0.5560E+01	-0.6906E+03	0.1787E-05	0.6906E+03	0.3952E+03	-0.1483E-06	-0.4945E+01	-0.1066E+01	0.9289	0.7566				
471	0.9352E+00	0.5602E+01	-0.7189E+03	0.1906E-05	0.7189E+03	0.3854E+03	-0.1519E-06	-0.5123E+01	-0.1141E+01	0.9329	0.7384				
472	0.7730E+00	0.5657E+01	-0.7392E+03	0.2027E-05	0.7392E+03	0.3739E+03	-0.1571E-06	-0.5293E+01	-0.1208E+01	0.9373	0.7251				
473	0.6209E+00	0.5727E+01	-0.7499E+03	0.2147E-05	0.7499E+03	0.3607E+03	-0.1640E-06	-0.5460E+01	-0.1233E+01	0.9422	0.7180				
474	0.4811E+00	0.5811E+01	-0.7509E+03	0.2265E-05	0.7509E+03	0.3463E+03	-0.1728E-06	-0.5624E+01	-0.1235E+01	0.9472	0.7173				
475	0.3557E+00	0.5910E+01	-0.7409E+03	0.2378E-05	0.7409E+03	0.3311E+03	-0.1839E-06	-0.5783E+01	-0.1205E+01	0.9522	0.7239				
476	0.2457E+00	0.6022E+01	-0.7201E+03	0.2485E-05	0.7201E+03	0.3154E+03	-0.1977E-06	-0.5940E+01	-0.1144E+01	0.9570	0.7376				
477	0.1537E+00	0.6147E+01	-0.6879E+03	0.2683E-05	0.6879E+03	0.2996E+03	-0.2151E-06	-0.6096E+01	-0.1052E+01	0.9615	0.7583				
478	0.8191E-01	0.6283E+01	-0.6438E+03	0.2670E-05	0.6438E+03	0.2842E+03	-0.2377E-06	-0.6249E+01	-0.9291E+00	0.9656	0.7858				
479	0.3236E-01	0.6427E+01	-0.5858E+03	0.2744E-05	0.5858E+03	0.2693E+03	-0.2684E-06	-0.6401E+01	-0.7769E+00	0.9693	0.8201				
480	0.6693E-02	0.6575E+01	-0.5026E+03	0.2797E-05	0.5026E+03	0.2555E+03	-0.3189E-06	-0.6552E+01	-0.5763E+00	0.9725	0.8651				
481	0.	0.6741E+01	-0.4139E+03	0.2836E-05	0.4139E+03	0.2412E+03	-0.3925E-06	-0.6718E+01	-0.3894E+00	0.9756	0.9070				
482	0.	0.6942E+01	-0.3575E+03	0.2871E-05	0.3575E+03	0.2239E+03	-0.4602E-06	-0.6919E+01	-0.2870E+00	0.9791	0.9300				
483	0.	0.7183E+01	-0.3157E+03	0.2907E-05	0.3157E+03	0.2053E+03	-0.5276E-06	-0.7160E+01	-0.2190E+00	0.9826	0.9451				
484	0.	0.7472E+01	-0.2818E+03	0.2941E-05	0.2818E+03	0.1857E+03	-0.5980E-06	-0.7449E+01	-0.1708E+00	0.9858	0.9561				
485	0.	0.7819E+01	-0.2533E+03	0.2974E-05	0.2533E+03	0.1653E+03	-0.6728E-06	-0.7796E+01	-0.1336E+00	0.9888	0.9644				
486	0.	0.8236E+01	-0.2287E+03	0.3004E-05	0.2287E+03	0.1447E+03	-0.7527E-06	-0.8213E+01	-0.1046E+00	0.9915	0.9709				
487	0.	0.8735E+01	-0.2074E+03	0.3032E-05	0.2074E+03	0.1242E+03	-0.8377E-06	-0.8712E+01	-0.8180E-01	0.9937	0.9760				

88	0.	0.9335E+01	-0.1888E+03	0.3057E-05	0.1888E+03	0.1045E+03	-0.9274E-06	-0.9312E+01	-0.6370E-01	0.9956	0.9801
89	0.	0.1006E+02	-0.1728E+03	0.3079E-05	0.1728E+03	0.8608E+02	-0.1021E-05	-0.1003E+02	-0.4934E-01	0.9970	0.9833
90	0.	0.1092E+02	-0.1590E+03	0.3097E-05	0.1590E+03	0.6928E+02	-0.1116E-05	-0.1090E+02	-0.3804E-01	0.9981	0.9859
91	0.	0.1187E+02	-0.1468E+03	0.3111E-05	0.1468E+03	0.5553E+02	-0.1214E-05	-0.1184E+02	-0.2874E-01	0.9988	0.9879
92	0.	0.1282E+02	-0.1375E+03	0.3121E-05	0.1375E+03	0.4514E+02	-0.1301E-05	-0.1280E+02	-0.2217E-01	0.9992	0.9894
93	0.	0.1378E+02	-0.1302E+03	0.3128E-05	0.1302E+03	0.3721E+02	-0.1377E-05	-0.1376E+02	-0.1729E-01	0.9994	0.9905
94	0.	0.1474E+02	-0.1241E+03	0.3133E-05	0.1241E+03	0.3104E+02	-0.1447E-05	-0.1471E+02	-0.1346E-01	0.9996	0.9914
95	0.	0.1569E+02	-0.1188E+03	0.3137E-05	0.1188E+03	0.2616E+02	-0.1513E-05	-0.1567E+02	-0.1027E-01	0.9997	0.9921
96	0.	0.1665E+02	-0.1139E+03	0.3140E-05	0.1139E+03	0.2226E+02	-0.1579E-05	-0.1663E+02	-0.7421E-02	0.9998	0.9927
97	0.	0.1761E+02	-0.1089E+03	0.3142E-05	0.1089E+03	0.1910E+02	-0.1654E-05	-0.1758E+02	-0.4618E-02	0.9999	0.9934
98	0.	0.1856E+02	-0.1027E+03	0.3144E-05	0.1027E+03	0.1652E+02	-0.1754E-05	-0.1854E+02	-0.1347E-02	0.9999	0.9941
99	0.	0.1952E+02	-0.9321E+02	0.3224E-05	0.9321E+02	0.1438E+02	-0.1982E-05	-0.1950E+02	0.3275E-02	0.9960	0.9951

**OFF-BODY POINTS (RAKES)**

I	COORDINATES			VELOCITIES				PRESS. RATIO				
	AXIAL	RADIAL	Y	AXIAL	RADIAL	Y	AXIAL	RADIAL	Y	AXIAL	RADIAL	Y
1	2.000E+00	1.999E+00	4.4712E+02	7.6661E+01	2.5365E-06	4.5364E+02	4.5364E+02	-7.6661E+01	7.2575E-06	0.8890	0.8891	0.8890
2	2.000E+00	2.000E+00	4.5288E+02	2.4641E+01	1.8737E-06	4.5355E+02	4.5355E+02	-2.4641E+01	3.8771E-07	0.8891	0.8892	0.8891
3	2.000E+00	3.000E+00	4.4266E+02	-1.5420E+01	1.8373E-06	4.6452E+02	4.6452E+02	1.5420E+01	8.871E-07	0.8839	0.8839	0.8839
4	2.000E+00	3.500E+00	4.7803E+02	-1.5144E+01	1.6951E-06	4.8015E+02	4.8015E+02	1.5144E+01	1.0850E-06	0.8792	0.8792	0.8792
5	2.000E+00	4.000E+00	4.9276E+02	-6.5329E+01	1.5955E-06	4.9707E+02	4.9707E+02	6.5329E+01	2.4277E-06	0.8679	0.8679	0.8679
6	2.000E+00	4.500E+00	5.0702E+02	-7.3619E+01	1.5119E-06	5.1233E+02	5.1233E+02	7.3619E+01	3.0218E-06	0.8601	0.8601	0.8601
7	2.000E+00	5.000E+00	5.1641E+02	-6.2166E+01	1.4262E-06	5.2014E+02	5.2014E+02	6.2166E+01	2.4022E-06	0.8560	0.8560	0.8560
8	2.000E+00	5.4981E+00	5.0205E+02	-1.1590E+01	-1.3189E-06	5.0218E+02	5.0218E+02	1.1590E+01	2.0326E-06	0.8653	0.8653	0.8653
9	4.000E+00	2.358E+00	6.1036E+02	8.5079E+01	1.7332E-06	6.1626E+02	6.1626E+02	-8.5079E+01	6.9727E-06	0.8023	0.8023	0.8023
10	4.000E+00	2.750E+00	6.1209E+02	3.9352E+01	1.4684E-06	6.1335E+02	6.1335E+02	-3.9352E+01	3.8918E-06	0.8635	0.8635	0.8635
11	4.000E+00	3.000E+00	6.1397E+02	1.8229E+01	1.3605E-06	6.1424E+02	6.1424E+02	-1.8229E+01	2.4831E-06	0.8020	0.8020	0.8020
12	4.000E+00	3.250E+00	6.1682E+02	-4.1962E+01	1.2746E-06	6.1682E+02	6.1682E+02	4.1962E+01	1.2772E-06	0.8563	0.8563	0.8563
13	4.000E+00	3.500E+00	6.2056E+02	-1.6187E+01	1.2043E-06	6.2077E+02	6.2077E+02	1.6187E+01	2.0748E-07	0.7996	0.7996	0.7996
14	4.000E+00	3.750E+00	6.2521E+02	-3.1305E+01	1.1452E-06	6.2599E+02	6.2599E+02	3.1305E+01	7.8268E-07	0.7965	0.7965	0.7965
15	4.000E+00	4.000E+00	6.3083E+02	-4.6154E+01	1.0942E-06	6.3252E+02	6.3252E+02	4.6154E+01	1.7481E-06	0.7926	0.7926	0.7926
16	4.000E+00	4.250E+00	6.3749E+02	-6.1705E+01	1.0049E-06	6.4047E+02	6.4047E+02	6.1705E+01	2.7506E-06	0.8563	0.8563	0.8563
17	4.000E+00	4.500E+00	6.4518E+02	-7.9225E+01	1.0093E-06	6.5003E+02	6.5003E+02	7.9225E+01	3.8657E-06	0.8563	0.8563	0.8563
18	4.000E+00	4.750E+00	6.5357E+02	-1.0045E+02	9.7289E-07	6.6124E+02	6.6124E+02	1.0045E+02	5.2132E-06	0.8563	0.8563	0.8563
19	4.000E+00	5.1310E+00	6.6303E+02	-1.4591E+02	-9.2267E-07	6.7623E+02	6.7623E+02	1.4591E+02	9.9083E-06	0.7657	0.7657	0.7657
20	4.000E+00	2.4990E+00	7.4964E+02	7.8704E+02	1.1775E-06	7.4968E+02	7.4968E+02	-7.8704E+02	1.6604E-06	0.7181	0.7181	0.7181
21	6.000E+00	2.750E+00	7.4046E+02	8.7025E+00	1.0680E-06	7.4052E+02	7.4052E+02	-8.7025E+00	1.6039E-06	0.7988	0.7988	0.7988
22	6.000E+00	3.000E+00	7.3281E+02	6.3661E+00	9.8260E-07	7.3284E+02	7.3284E+02	-6.3661E+00	1.3746E-06	0.7988	0.7988	0.7988
23	6.000E+00	3.250E+00	7.2880E+02	3.2203E+00	9.1329E-07	7.2881E+02	7.2881E+02	-3.2203E+00	1.1116E-06	0.7988	0.7988	0.7988
24	6.000E+00	3.500E+00	7.2719E+02	2.8373E-01	8.5535E-07	7.2719E+02	7.2719E+02	-2.8373E-01	8.7282E-07	0.7988	0.7988	0.7988
25	6.000E+00	3.750E+00	7.2729E+02	-2.0213E+00	8.0564E-07	7.2729E+02	7.2729E+02	2.0213E+00	6.8116E-07	0.7988	0.7988	0.7988
26	6.000E+00	4.000E+00	7.2857E+02	-3.4643E+00	7.6197E-07	7.2858E+02	7.2858E+02	3.4643E+00	5.4862E-07	0.7988	0.7988	0.7988
27	6.000E+00	4.250E+00	7.3056E+02	-3.9040E+00	7.3057E+02	7.3057E+02	7.3057E+02	3.9040E+00	4.8321E-07	0.7988	0.7988	0.7988
28	6.000E+00	4.500E+00	7.3274E+02	-3.3019E+00	6.8679E-07	7.3275E+02	7.3275E+02	3.3019E+00	4.8344E-07	0.7988	0.7988	0.7988
29	6.000E+00	4.750E+00	7.3454E+02	-1.8159E+00	6.5324E-07	7.3454E+02	7.3454E+02	1.8159E+00	5.4141E-07	0.7988	0.7988	0.7988
30	6.000E+00	5.000E+00	7.3939E+02	0.	-6.2058E-07	7.2939E+02	7.2939E+02	-3.8217E-14	-6.2058E-07	0.7988	0.7988	0.7988

I	COORDINATES			NEW CP	-ANGLES-					QFRACT
	AXIAL X	RADIAL Y	VBRI		CPC	MERIDIONAL ALPHA	FLOW BETA	UNDERTURNING ETA	SPANWISE ZETA	
1	2.0000E+00	1.9996E+00	4.1759E+02	-4.6955E-01	9.7290E+00	4.8748E-08	-9.7290E+00	9.3001E-07	3.25C4E-07	0.
2	2.0000E+00	2.5000E+00	4.1759E+02	-4.6936E-01	3.1143E+00	2.6213E-07	-3.1143E+00	4.5449E-07	2.6251E-07	8.0189E-02
3	2.0000E+00	3.0000E+00	4.1759E+02	-4.9250E-01	-1.9023E+00	2.2662E-07	1.9023E+00	1.0955E-07	2.2675E-07	1.7980E-01
4	2.0000E+00	3.5000E+00	4.1759E+02	-5.2627E-01	5.3949E+00	2.0227E-07	5.3949E+00	-1.30C5E-07	2.0317E-07	3.0011E-01
5	2.0000E+00	4.0000E+00	4.1759E+02	-5.6382E-01	7.5521E+00	1.8391E-07	7.5521E+00	-2.8228E-07	1.8552E-07	4.4219E-01
6	2.0000E+00	4.5000E+00	4.1759E+02	-5.9859E-01	8.2616E+00	1.6909E-07	8.2616E+00	-3.4148E-07	1.7086E-07	6.0690E-01
7	2.0000E+00	5.0000E+00	4.1759E+02	-6.1668E-01	-1.5701E-07	1.5701E-07	6.8643E+00	-2.6652E-07	1.5824E-07	7.9437E-01
8	2.0000E+00	5.4981E+00	4.1759E+02	-5.7537E-01	-1.3224E+00	1.5048E-07	1.3224E+00	-2.3197E-07	-1.5052E-07	1.0000E+00
9	2.0000E+00	5.9598E+00	4.1759E+02	-8.5598E-01	7.9354E+00	1.6114E-07	-7.9354E+00	6.5454E-07	1.6270E-07	0.
10	4.0000E+00	2.7500E+00	5.2407E+02	-8.4831E-01	3.6786E+00	1.3717E-07	-3.6786E+00	3.6430E-07	1.3745E-07	1.0067E-01
11	4.0000E+00	3.0000E+00	5.2407E+02	-8.5066E-01	1.7809E+00	1.2690E-07	-1.7809E+00	2.3172E-07	1.2656E-07	1.6810E-01
12	4.0000E+00	3.2500E+00	5.2407E+02	-8.5745E-01	3.7897E-03	1.1840E-07	-3.7897E-03	1.1864E-07	1.1840E-07	2.4162E-01
13	4.0000E+00	3.5000E+00	5.2407E+02	-8.6791E-01	1.4942E+00	1.1116E-07	1.4942E+00	-1.9156E-08	1.1119E-07	3.2131E-01
14	4.0000E+00	3.7500E+00	5.2407E+02	-8.8179E-01	-2.8665E+00	0.9482E-07	2.8665E+00	-7.1727E-08	1.0495E-07	4.0727E-01
15	4.0000E+00	4.0000E+00	5.2407E+02	-8.9924E-01	4.1845E+00	9.9121E-08	4.1845E+00	-1.5877E-07	9.9386E-08	4.9962E-01
16	4.0000E+00	4.2500E+00	5.2407E+02	-9.2068E-01	5.5287E+00	9.3879E-08	5.5287E+00	-2.4722E-07	9.4318E-08	5.9850E-01
17	4.0000E+00	4.5000E+00	5.2407E+02	-9.4667E-01	7.0066E+00	8.8961E-08	7.0066E+00	-3.4365E-07	8.9629E-08	7.0406E-01
18	4.0000E+00	4.7500E+00	5.2407E+02	-9.7747E-01	8.7376E+00	8.4300E-08	8.7376E+00	-4.5702E-07	8.5289E-08	8.1638E-01
19	4.0000E+00	5.1310E+00	5.2407E+02	-1.0191E+01	1.2461E+01	7.8176E-08	1.2461E+01	-8.5977E-07	-9.0022E-08	1.0000E+00

	6.0000E+00	2.4990E+00	5.8435E+02	-1.2311E+00	6.0152E-01	8.9853E-08	-6.0152E-01	1.2690E-07	8.9858E-08	0.
16	6.0000E+00	2.7500E+00	5.8435E+02	-1.2040E+00	6.7335E-01	8.2632E-08	-6.7335E-01	1.2411E-07	8.2637E-08	7.0899E-02
17	6.0000E+00	3.0000E+00	5.8435E+02	-1.1814E+00	4.9773E-01	7.6823E-08	-4.9773E-01	1.0748E-07	7.6826E-08	1.4780E-01
18	6.0000E+00	3.2500E+00	5.8435E+02	-1.1698E+00	2.5317E-01	7.1798E-08	-2.5317E-01	8.7790E-08	7.1799E-08	2.3105E-01
19	6.0000E+00	3.5000E+00	5.8435E+02	-1.1649E+00	2.2355E-02	6.7393E-08	-2.2355E-02	8.7307E-08	6.7393E-08	3.2078E-01
20	6.0000E+00	3.7500E+00	5.8435E+02	-1.1652E+00	-1.5924E-01	6.3668E-08	1.5924E-01	5.3662E-08	6.3668E-08	4.1710E-01
21	6.0000E+00	4.0000E+00	5.8435E+02	-1.1690E+00	-2.7244E-01	5.9921E-08	2.7244E-01	4.3144E-08	5.9922E-08	5.2012E-01
22	6.0000E+00	4.2500E+00	5.8435E+02	-1.1748E+00	-3.0618E-01	5.6681E-08	3.0618E-01	3.7826E-08	5.6682E-08	6.2992E-01
23	6.0000E+00	4.5000E+00	5.8435E+02	-1.1812E+00	-2.5819E-01	5.3702E-08	2.5819E-01	3.7802E-08	5.3703E-08	7.4655E-01
24	6.0000E+00	4.7500E+00	5.8435E+02	-1.1864E+00	-1.4164E-01	5.0954E-08	1.4164E-01	4.2231E-08	5.0954E-08	8.7002E-01
	6.0000E+00	5.0000E+00	5.8435E+02	-1.1713E+00	0.	-4.8748E-08	-3.0021E-15	-4.8748E-08	-4.8748E-08	1.0000E+00

# RELATIVE ROTOR INLET DATA

X = 6.0000 UTIP = 900.0000

Y	U	VZPRIME	VPRIM	MPRIME	BETAPR	VZPRST	VPRST	MPRS	BETAPS
2.4990E+00	4.4982E+02	-4.4982E+02	8.7428E+02	8.2139E-01	-3.0364E+01	-4.4982E+02	8.7428E+02	8.2139E-01	-3.0364E+01
2.7500E+00	4.9500E+02	-4.9500E+02	8.9072E+02	8.3583E-01	-3.3761E+01	-4.9500E+02	8.9072E+02	8.3583E-01	-3.3761E+01
3.0000E+00	5.4000E+02	-5.4000E+02	9.1030E+02	8.5336E-01	-3.6385E+01	-5.4000E+02	9.1030E+02	8.5336E-01	-3.6385E+01
3.2500E+00	5.8500E+02	-5.8500E+02	9.3455E+02	8.7364E-01	-3.8753E+01	-5.8500E+02	9.3455E+02	8.7364E-01	-3.8753E+01
3.5000E+00	6.3000E+02	-6.3000E+02	9.6214E+02	9.0130E-01	-4.0904E+01	-6.3000E+02	9.6214E+02	9.0130E-01	-4.0904E+01
3.7500E+00	6.7500E+02	-6.7500E+02	9.9226E+02	9.2952E-01	-4.2865E+01	-6.7500E+02	9.9226E+02	9.2952E-01	-4.2865E+01
4.0000E+00	7.2000E+02	-7.2000E+02	1.0243E+03	9.5971E-01	-4.4661E+01	-7.2000E+02	1.0243E+03	9.5971E-01	-4.4661E+01
4.2500E+00	7.6500E+02	-7.6500E+02	1.0578E+03	9.9135E-01	-4.6319E+01	-7.6500E+02	1.0578E+03	9.9135E-01	-4.6319E+01
4.5000E+00	8.1000E+02	-8.1000E+02	1.0923E+03	1.0239E+00	-4.7867E+01	-8.1000E+02	1.0923E+03	1.0239E+00	-4.7867E+01
4.7500E+00	8.5500E+02	-8.5500E+02	1.1272E+03	1.0569E+00	-4.9334E+01	-8.5500E+02	1.1272E+03	1.0569E+00	-4.9334E+01
5.0000E+00	9.0000E+02	-9.0000E+02	1.1584E+03	1.0855E+00	-5.0978E+01	-9.0000E+02	1.1584E+03	1.0855E+00	-5.0978E+01

# RAKE WEIGHT FLOW DATA

I	X	(Q11)-QBAR	QBAR	QS TOT	QFR
1	2.0000E+00	6.0734E-02	1.9409E+01	1.0000E+00	
2	4.0000E+00	2.0013E-02	1.8664E+01	1.0000E+00	
3	6.0000E+00	0.	1.8297E+01	1.0000E+00	

# STREAMLINES

X = 2.000

QSTRM	YSTRM
2.0000E-02	2.13255E+00
4.0000E-02	2.26011E+00
6.0000E-02	2.38223E+00
8.0000E-02	2.49892E+00
1.0000E-01	2.60565E+00
1.2000E-01	2.70919E+00
1.4000E-01	2.80958E+00
1.6000E-01	2.90683E+00
1.8000E-01	3.00090E+00
2.0000E-01	3.08886E+00
2.2000E-01	3.17488E+00
2.4000E-01	3.25896E+00
2.6000E-01	3.34110E+00
2.8000E-01	3.42130E+00
3.0000E-01	3.49956E+00
3.2000E-01	3.57381E+00
3.4000E-01	3.64679E+00
3.6000E-01	3.71851E+00

3.80000E-01 3.78897E+00  
 4.00000E-01 3.85816E+00  
 4.20000E-01 3.92610E+00  
 4.40000E-01 3.99277E+00  
 4.60000E-01 4.05680E+00  
 4.80000E-01 4.11980E+00  
 5.00000E-01 4.18196E+00  
 5.20000E-01 4.24328E+00  
 5.40000E-01 4.30377E+00  
 5.60000E-01 4.36342E+00  
 5.80000E-01 4.42223E+00  
 6.00000E-01 4.48020E+00  
 6.20000E-01 4.53637E+00  
 6.40000E-01 4.59147E+00  
 6.60000E-01 4.64608E+00  
 6.80000E-01 4.70018E+00  
 7.00000E-01 4.75379E+00  
 7.20000E-01 4.80689E+00  
 7.40000E-01 4.85950E+00  
 7.60000E-01 4.91162E+00  
 7.80000E-01 4.96323E+00  
 8.00000E-01 5.01435E+00  
 8.20000E-01 5.06496E+00  
 8.40000E-01 5.11508E+00  
 8.60000E-01 5.16470E+00  
 8.80000E-01 5.21383E+00  
 9.00000E-01 5.26245E+00  
 9.20000E-01 5.31058E+00  
 9.40000E-01 5.35820E+00  
 9.60000E-01 5.40533E+00  
 9.80000E-01 5.45197E+00  
 1.00000E+00 5.49810E+00

X = 4.000

QSTRM	YSTRM
2.00000E-02	2.41496E+00
4.00000E-02	2.50168E+00
6.00000E-02	2.58599E+00
8.00000E-02	2.66790E+00
1.00000E-01	2.74739E+00
1.20000E-01	2.82370E+00
1.40000E-01	2.89822E+00
1.60000E-01	2.97101E+00
1.80000E-01	3.04172E+00
2.00000E-01	3.11075E+00
2.20000E-01	3.17841E+00
2.40000E-01	3.24469E+00
2.60000E-01	3.30922E+00
2.80000E-01	3.37260E+00
3.00000E-01	3.43488E+00
3.20000E-01	3.49605E+00
3.40000E-01	3.55579E+00
3.60000E-01	3.61460E+00
3.80000E-01	3.67251E+00
4.00000E-01	3.72952E+00
4.20000E-01	3.78542E+00
4.40000E-01	3.84044E+00
4.60000E-01	3.89470E+00
4.80000E-01	3.94822E+00
5.00000E-01	4.00099E+00

5.20000E-01  
 5.40000E-01  
 5.60000E-01  
 5.80000E-01  
 6.00000E-01  
 6.20000E-01  
 6.40000E-01  
 6.60000E-01  
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 8.40000E-01  
 8.60000E-01  
 8.80000E-01  
 9.00000E-01  
 9.20000E-01  
 9.40000E-01  
 9.60000E-01  
 9.80000E-01  
 1.00000E+00

X = 6.000

QSTRM  
 2.00000E-02  
 4.00000E-02  
 6.00000E-02  
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 1.00000E-01  
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 1.40000E-01  
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 5.20000E-01  
 5.40000E-01  
 5.60000E-01  
 5.80000E-01  
 6.00000E-01  
 6.20000E-01  
 6.40000E-01

YSTRM  
 2.57179E+00  
 2.64302E+00  
 2.71269E+00  
 2.78054E+00  
 2.84675E+00  
 2.91173E+00  
 2.97547E+00  
 3.03772E+00  
 3.09875E+00  
 3.15878E+00  
 3.21781E+00  
 3.27568E+00  
 3.33246E+00  
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 3.44357E+00  
 3.49790E+00  
 3.55114E+00  
 3.60369E+00  
 3.65556E+00  
 3.70676E+00  
 3.75723E+00  
 3.80686E+00  
 3.85591E+00  
 3.90441E+00  
 3.95234E+00  
 3.99971E+00  
 4.04631E+00  
 4.09244E+00  
 4.13809E+00  
 4.18328E+00  
 4.22799E+00  
 4.27214E+00

6.60000E-01	4.31576E+00
6.80000E-01	4.35899E+00
7.00000E-01	4.40183E+00
7.20000E-01	4.44427E+00
7.40000E-01	4.48631E+00
7.60000E-01	4.52782E+00
7.80000E-01	4.56893E+00
8.00000E-01	4.60972E+00
8.20000E-01	4.65019E+00
8.40000E-01	4.69034E+00
8.60000E-01	4.73016E+00
8.80000E-01	4.76967E+00
9.00000E-01	4.80886E+00
9.20000E-01	4.84773E+00
9.40000E-01	4.88628E+00
9.60000E-01	4.92450E+00
9.80000E-01	4.96241E+00
1.00000E+00	5.00000E+00

\*01\* UNIT05, EOF.

REC= 00000 FIL= 00002

## REFERENCES

1. Stockman, Norbert O.; and Lieblein, Seymour: Theoretical Analysis of Flow in VTOL Lift Fan Inlets Without Crossflow. NASA TN D-5065, 1969.
2. Stockman, Norbert O.: Potential Flow Solutions for Inlets of VTOL Lift Fans and Engines. Analytical Methods in Aircraft Aerodynamics. NASA SP-228, 1970, pp. 659-681.
3. Albers, James A.: Theoretical and Experimental Internal Flow Characteristics of a 13.97-Centimeter-Diameter Inlet at STOL Takeoff and Approach Conditions. NASA TN D-7185, 1973.
4. Smith, A. M. O.; and Pierce, Jesse: Exact Solution of the Neumann Problem. Calculation of Non-Circulatory Plane and Axially Symmetric Flows About or Within Arbitrary Boundaries. Rep. ES-26988, Douglas Aircraft Co., Apr. 25, 1958.
5. Hess, J. L.; and Smith, A. M. O.: Calculation of Potential Flow About Arbitrary Bodies. Progress in Aeronautical Sciences, vol. 8, D. Küchemann, ed., Pergamon Press, 1967, pp. 1-138.
6. Hess, John L.: Calculation of Potential Flow About Bodies of Revolution Having Axes Perpendicular to the Free-Stream Direction. J. Aerospace Sci., vol. 29, no. 6, June 1962, pp. 726-742.
7. Hess, John L.; and Smith, A. M. O.: A General Method for Calculating Low Speed Flow About Inlets. Aerodynamics of Power Plant Installation, Part 1. AGARDograph 103, pt. 1, 1965, pp. 345-372.
8. Lieblein, S.; and Stockman, N. O.: Compressibility Correction for Internal Flow Solutions. J. Aircraft, vol. 9, no. 4, Apr. 1972, pp. 312-313.



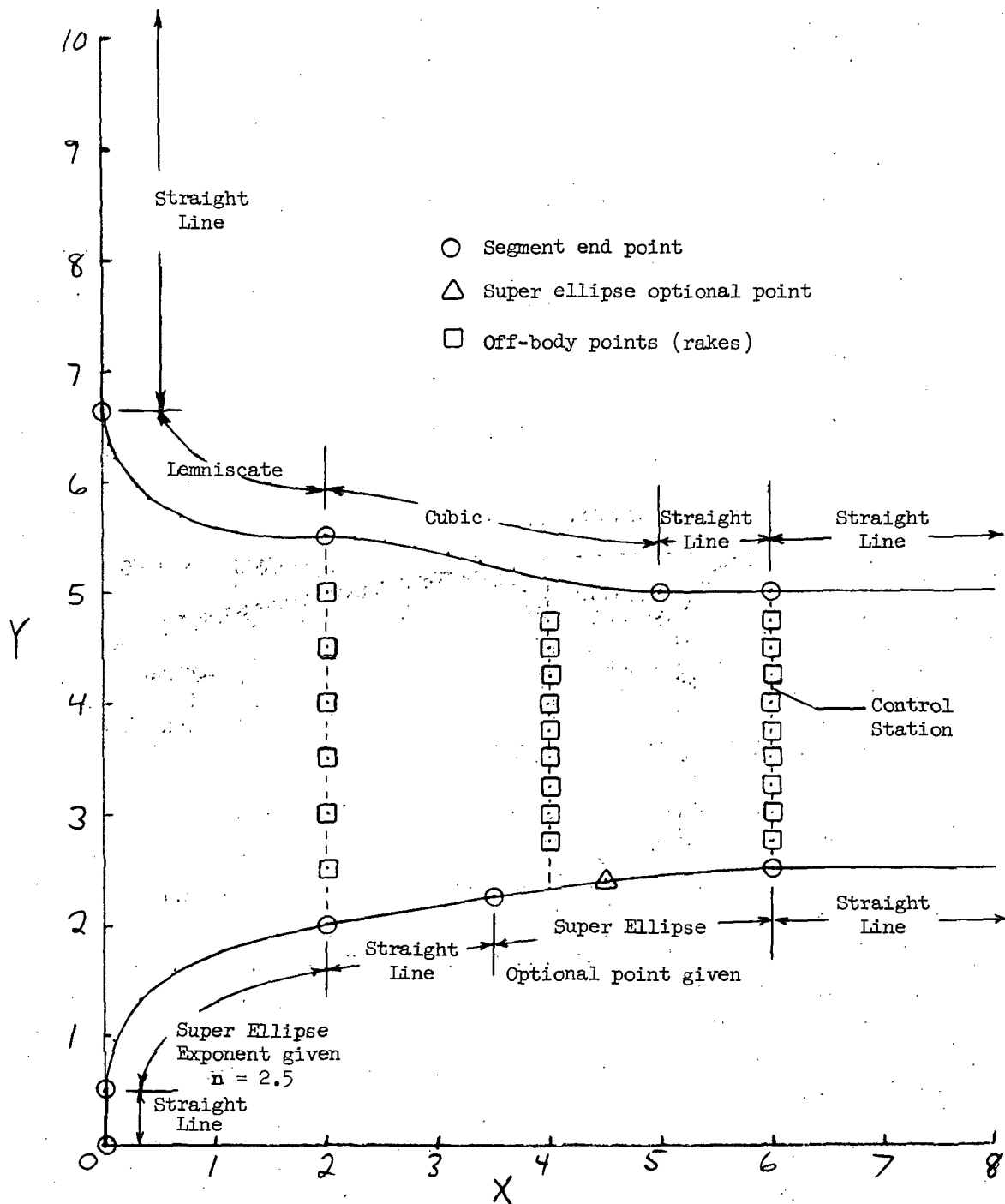


Figure 1. Test case showing segmentation of inlet surfaces.

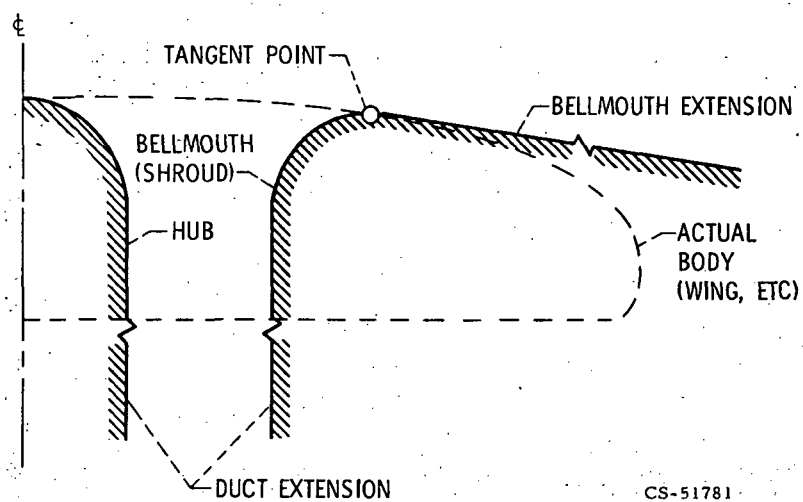


Figure 2. - Idealized profile of VTOL inlet.

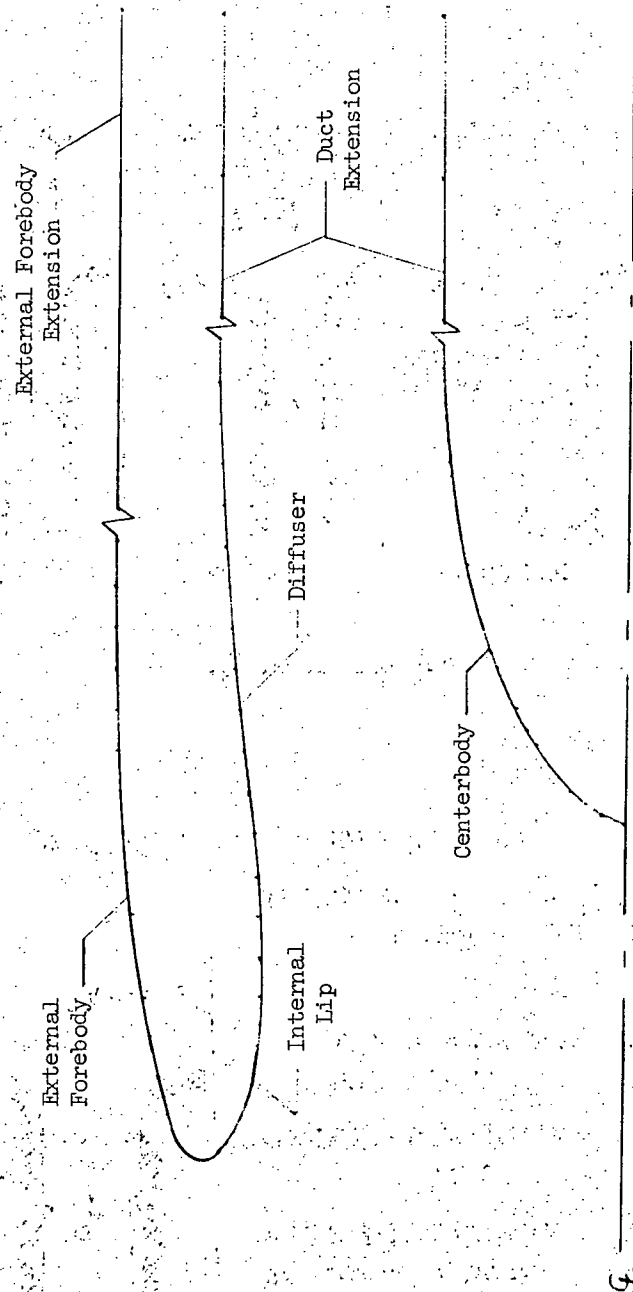


Figure 3. Idealized profile of conventional inlet.

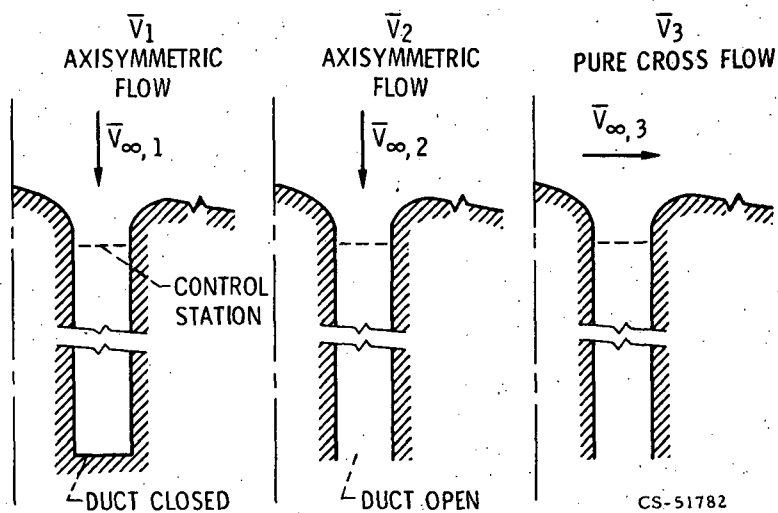


Figure 4. - Basic solutions,  $\bar{V}_1$ .

$$\text{AT ANY POINT, } \bar{V} = A\bar{V}_1 + B\bar{V}_2 + C\bar{V}_3$$

A, B, AND C ARE DETERMINED BY  
SPECIFYING VALUES OF:

- $V_c$  AVERAGE AXIAL VELOCITY  
AT CONTROL STATION
- $V_\infty$  MAGNITUDE OF FREE STREAM  
VELOCITY
- $\alpha$  DIRECTION OF FREE STREAM  
VELOCITY RELATIVE TO  
THE INLET AXIS

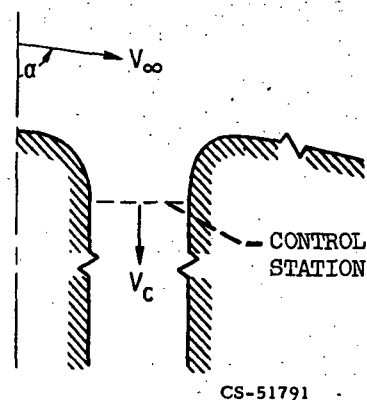


Figure 5. - Combined solution,  $\bar{V}$ .

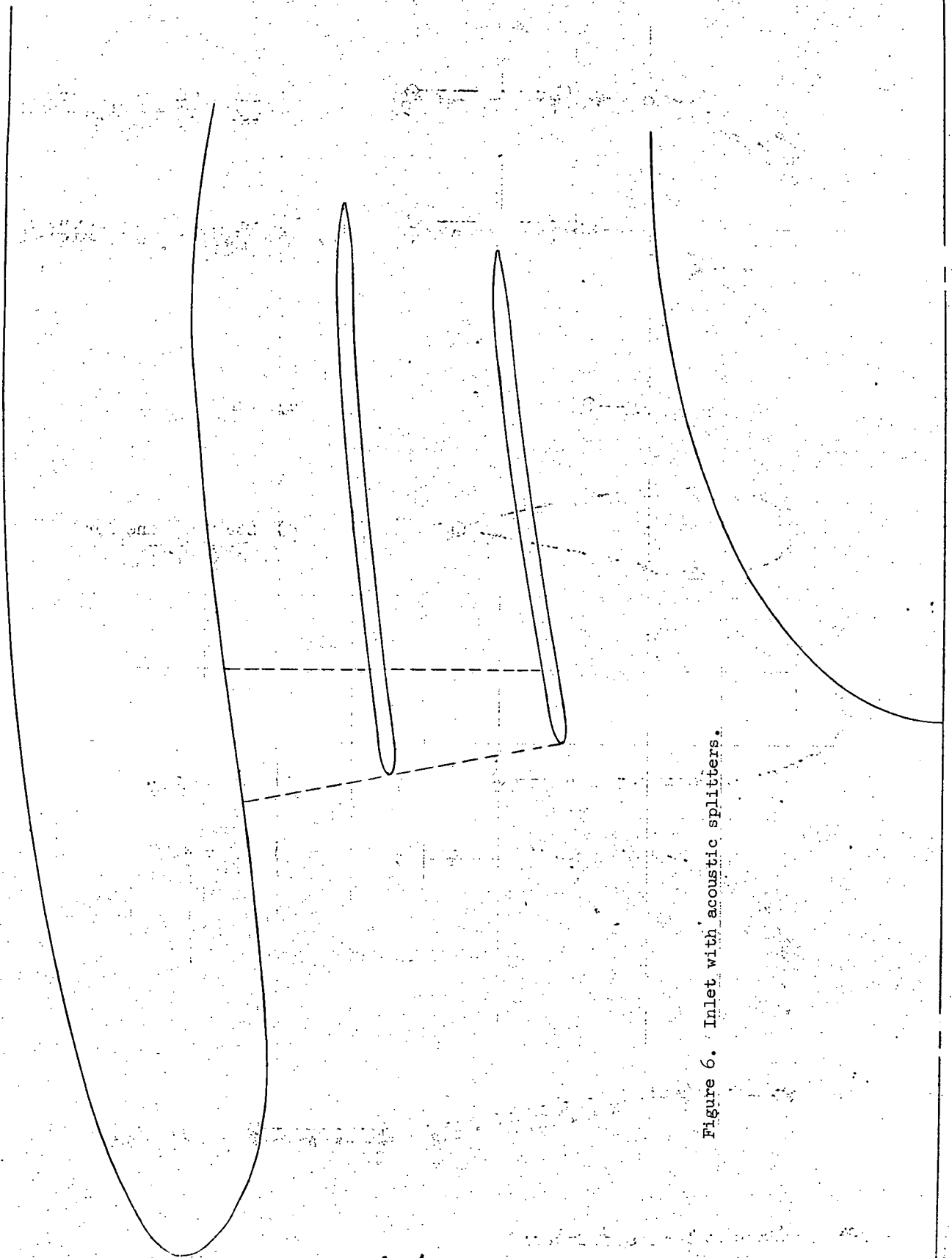
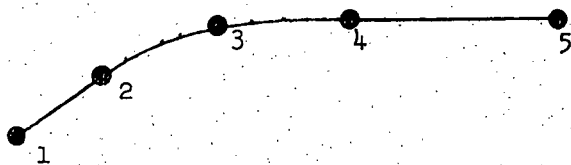


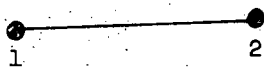
Figure 6. Inlet with acoustic splitters.



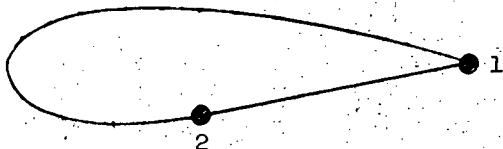
a) Super ellipse; optional point 3 specified.



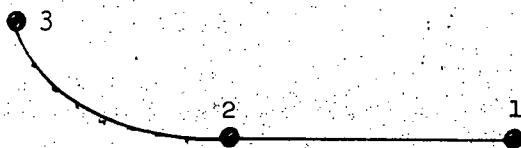
b) Super ellipse; exponent specified.



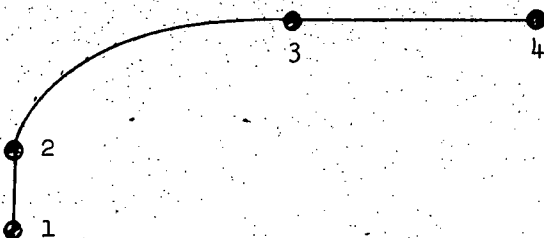
c) Straight line.



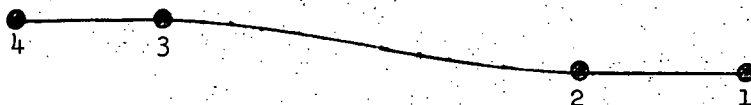
d) Straight line for closed body.



e) Lemniscate.



f) Ellipse.



g) Cubic.

Figure 7. Sketches for SCIRCL input.